

# Supplementary Materials

Article

## Unleashing Black Sea Cucumber's Potential: Identifying Anti-Cancer Compounds Through In Silico Drug Discovery

Muhammad Fahrury Romdendine <sup>1</sup>, Wisnu Ananta Kusuma <sup>1,2,4\*</sup>, Annisa <sup>1</sup>, Mala Nurilmala <sup>3</sup>, Rizka Fitriani <sup>2</sup>

- <sup>1</sup> Department of Computer Sciences, Faculty of Mathematics and Natural Sciences, IPB University, 16680 Bogor, Indonesia; romfahrury@apps.ipb.ac.id; ananta@apps.ipb.ac.id; annisa@apps.ipb.ac.id
- <sup>2</sup> Biopharmaceuticals Research Center, Institute of Research and Community Service, IPB University, 16680 Bogor, Indonesia; ananta@apps.ipb.ac.id
- <sup>3</sup> Department of Aquatic Product Technology, Faculty of Fisheries and Marine Sciences, IPB University, 16680 Bogor, Indonesia
- <sup>4</sup> Indonesian Society of Bioinformatics and Biodiversity, Indonesia
- \* Correspondence: ananta@apps.ipb.ac.id

**Table S1** Cancer-related proteins acquired from THPA, TCGA, and Ijah Analytics as mentioned in Data Acquisitions and Preprocessing section of the Results chapter.

| Protein Name | Uniprot ID |
|--------------|------------|
| NOD2_HUMAN   | Q9UEE5     |
| BRD3_HUMAN   | P36507     |
| PSA3_HUMAN   | P25054     |
| SIR1_HUMAN   | P09467     |
| AK1C3_HUMAN  | Q03164     |
| LATS2_HUMAN  | P07332     |
| EF1A1_HUMAN  | P09211     |
| MTP_HUMAN    | P05091     |
| IL2_HUMAN    | Q14012     |
| KDM5C_HUMAN  | Q13639     |
| MEN1_HUMAN   | P31153     |
| ANM6_HUMAN   | Q9UKE5     |
| CBPB1_HUMAN  | Q13315     |
| HDAC6_HUMAN  | P14920     |
| KSYK_HUMAN   | Q16584     |
| DCLK1_HUMAN  | P24863     |
| CP1B1_HUMAN  | Q04828     |
| RAF1_HUMAN   | P49720     |
| MP2K6_HUMAN  | P25774     |
| FNTA_HUMAN   | P00519     |
| PK3C3_HUMAN  | Q8NEB9     |
| CDK5_HUMAN   | P08254     |
| HS90A_HUMAN  | P28072     |
| KEAP1_HUMAN  | Q8WTX7     |
| DAPK1_HUMAN  | O15264     |
| APC_HUMAN    | Q02153     |

| Protein Name | Uniprot ID |
|--------------|------------|
| ACACB_HUMAN  | P33176     |
| CSK23_HUMAN  | P28566     |
| MAPK5_HUMAN  | P29375     |
| PKR2_HUMAN   | Q9UHL4     |
| DCMC_HUMAN   | P41587     |
| HEXB_HUMAN   | P29401     |
| WEE2_HUMAN   | P41182     |
| M3K11_HUMAN  | P48764     |
| TNIK_HUMAN   | O96020     |
| CARM1_HUMAN  | P16455     |
| KAT6A_HUMAN  | Q9NYV4     |
| LIMK2_HUMAN  | P98170     |
| CTNB1_HUMAN  | P00918     |
| IKKB_HUMAN   | Q16513     |
| PKD2_HUMAN   | Q92793     |
| LITAF_HUMAN  | P18031     |
| BIRC3_HUMAN  | P68400     |
| PGDH_HUMAN   | Q9HC98     |
| CAH7_HUMAN   | P08238     |
| CLTR2_HUMAN  | P04150     |
| ABCG2_HUMAN  | O14746     |
| IF4A1_HUMAN  | Q99732     |
| LCK_HUMAN    | P51813     |
| DDR2_HUMAN   | Q15303     |
| VGFR2_HUMAN  | P04626     |
| MP2K2_HUMAN  | Q15418     |
| FKB1A_HUMAN  | Q9H3N8     |
| CSK2B_HUMAN  | P11802     |
| TTK_HUMAN    | Q9BW60     |
| M3K1_HUMAN   | Q9NRY4     |
| UBP1_HUMAN   | P51684     |
| EZH2_HUMAN   | P13631     |
| GPER1_HUMAN  | P08922     |
| PARG_HUMAN   | P45983     |
| RARB_HUMAN   | P15428     |
| MRCKG_HUMAN  | Q16552     |
| ABCC8_HUMAN  | P39086     |
| SCN9A_HUMAN  | P18564     |
| ESR1_HUMAN   | P29323     |
| CCDC6_HUMAN  | P39748     |
| BCL2_HUMAN   | Q9BPZ7     |
| CCR6_HUMAN   | P46531     |
| PLD1_HUMAN   | P27815     |
| RXRG_HUMAN   | Q9BYT3     |
| TNK1_HUMAN   | Q00537     |
| AMD_HUMAN    | P11362     |

| Protein Name | Uniprot ID |
|--------------|------------|
| NTRK3_HUMAN  | Q96SB4     |
| MCL1_HUMAN   | P31751     |
| XIAP_HUMAN   | P18825     |
| MMP3_HUMAN   | Q7Z601     |
| CP1A1_HUMAN  | P08069     |
| CP2CJ_HUMAN  | P16591     |
| ST14_HUMAN   | Q13489     |
| CD209_HUMAN  | P12268     |
| TYDP2_HUMAN  | Q9UDY8     |
| HS90B_HUMAN  | P23526     |
| IRAK3_HUMAN  | Q12852     |
| F16P1_HUMAN  | P34972     |
| BMR1A_HUMAN  | P49674     |
| 5HT1E_HUMAN  | Q92830     |
| CXCR4_HUMAN  | P23467     |
| MMP10_HUMAN  | P67870     |
| ATM_HUMAN    | Q8IW41     |
| P85A_HUMAN   | P07947     |
| SETD2_HUMAN  | Q6DT37     |
| PGES2_HUMAN  | Q9BY08     |
| GALT2_HUMAN  | P51532     |
| LGMN_HUMAN   | P08581     |
| TOP1_HUMAN   | O43293     |
| FAK1_HUMAN   | Q16236     |
| ELOV1_HUMAN  | P41968     |
| CATS_HUMAN   | Q00536     |
| GP142_HUMAN  | P61073     |
| SCN7A_HUMAN  | Q13882     |
| ANT3_HUMAN   | O60885     |
| NTM1A_HUMAN  | P40337     |
| JAK1_HUMAN   | Q9H7Z7     |
| KAT6B_HUMAN  | P35610     |
| PAK4_HUMAN   | P25105     |
| 5HT4R_HUMAN  | Q08881     |
| HLAA_HUMAN   | Q16875     |
| PAR2_HUMAN   | P30536     |
| FNTB_HUMAN   | P01116     |
| DCNL1_HUMAN  | Q9Y2H1     |
| PTN11_HUMAN  | Q06124     |
| PDE4B_HUMAN  | O15075     |
| FGFR1_HUMAN  | O15164     |
| CAH2_HUMAN   | P29597     |
| MMP25_HUMAN  | O00763     |
| P3C2A_HUMAN  | O43924     |
| FES_HUMAN    | P78417     |
| ANM1_HUMAN   | P04066     |

| <b>Protein Name</b> | <b>Uniprot ID</b> |
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| ERCC5_HUMAN         | P62805            |
| KLK14_HUMAN         | Q9UBE8            |
| EP300_HUMAN         | O75582            |
| ST38L_HUMAN         | Q9H4A3            |
| CSF1R_HUMAN         | Q9NS75            |
| NTRK1_HUMAN         | O00748            |
| EPHA3_HUMAN         | Q6PHR2            |
| ATF4_HUMAN          | P42330            |
| CASP3_HUMAN         | O43895            |
| UBE2F_HUMAN         | Q99720            |
| NR2C2_HUMAN         | P10644            |
| ITB5_HUMAN          | P51617            |
| ITPR3_HUMAN         | P06401            |
| CCNY_HUMAN          | P78536            |
| MDM4_HUMAN          | Q9P0G3            |
| PAK6_HUMAN          | Q99873            |
| OXDA_HUMAN          | P41252            |
| TEC_HUMAN           | P14735            |
| ATX2_HUMAN          | Q9H1C0            |
| SMCA2_HUMAN         | P10398            |
| CECR2_HUMAN         | Q14680            |
| PB1_HUMAN           | P49116            |
| LOX15_HUMAN         | P34896            |
| SRPK1_HUMAN         | P36873            |
| NSD2_HUMAN          | O95835            |
| RASK_HUMAN          | P53667            |
| IDE_HUMAN           | Q92794            |
| ITA2_HUMAN          | P49760            |
| MOT1_HUMAN          | O60502            |
| FEN1_HUMAN          | P25106            |
| CCNB1_HUMAN         | P09619            |
| PUR2_HUMAN          | Q00535            |
| CRBN_HUMAN          | Q8TD19            |
| CDK12_HUMAN         | O95251            |
| PPARG_HUMAN         | Q04771            |
| ITK_HUMAN           | P17931            |
| PDE5A_HUMAN         | Q99814            |
| ERBB4_HUMAN         | P37173            |
| MP2K1_HUMAN         | Q08499            |
| FGFR3_HUMAN         | Q15059            |
| KAPCA_HUMAN         | Q9H422            |
| PGH2_HUMAN          | P14902            |
| CDK18_HUMAN         | Q15022            |
| MDM2_HUMAN          | P30291            |
| OAT_HUMAN           | P09238            |
| KS6B1_HUMAN         | P23141            |

| <b>Protein Name</b> | <b>Uniprot ID</b> |
|---------------------|-------------------|
| PSB3_HUMAN          | P35354            |
| CILK1_HUMAN         | Q8WYB5            |
| CCNB2_HUMAN         | P49768            |
| STAT3_HUMAN         | P06730            |
| FABP5_HUMAN         | P53778            |
| TYK2_HUMAN          | Q12879            |
| PRGR_HUMAN          | Q13191            |
| KAP0_HUMAN          | P14635            |
| ITAV_HUMAN          | P48443            |
| TKT_HUMAN           | P68106            |
| PGFRB_HUMAN         | Q01668            |
| FURIN_HUMAN         | Q13464            |
| SRMS_HUMAN          | P31749            |
| EST1_HUMAN          | P09958            |
| WNK1_HUMAN          | P55085            |
| ADA2C_HUMAN         | P33981            |
| MMP11_HUMAN         | O75376            |
| KS6A5_HUMAN         | O14929            |
| GCYB1_HUMAN         | Q16832            |
| HIPK2_HUMAN         | Q9UM73            |
| SCNBA_HUMAN         | P52333            |
| ABL2_HUMAN          | P07949            |
| KAT7_HUMAN          | Q9NQS7            |
| CNR1_HUMAN          | O94782            |
| CATH_HUMAN          | P68431            |
| CATD_HUMAN          | Q07002            |
| HDAC9_HUMAN         | P36897            |
| KPCD3_HUMAN         | Q02750            |
| HXK1_HUMAN          | P08236            |
| LIMK1_HUMAN         | P05412            |
| JAK2_HUMAN          | P04637            |
| AK1C1_HUMAN         | P15086            |
| NR4A2_HUMAN         | O00443            |
| ADK_HUMAN           | Q99538            |
| EPHB2_HUMAN         | Q9HAZ1            |
| S1PR1_HUMAN         | O95271            |
| SMCA4_HUMAN         | O43521            |
| SQOR_HUMAN          | Q9H2X6            |
| B2CL1_HUMAN         | Q9NRG4            |
| TBK1_HUMAN          | P24158            |
| AGAL_HUMAN          | Q86WV6            |
| IRAK1_HUMAN         | Q99835            |
| F263_HUMAN          | P23443            |
| ACKR3_HUMAN         | Q9NPC1            |
| PDE6D_HUMAN         | P10721            |
| RN5A_HUMAN          | Q9Y618            |

| <b>Protein Name</b> | <b>Uniprot ID</b> |
|---------------------|-------------------|
| KPCD1_HUMAN         | P30281            |
| PA24B_HUMAN         | Q9UBE0            |
| RORA_HUMAN          | Q9UHD2            |
| KINH_HUMAN          | Q15759            |
| SMG1_HUMAN          | Q99685            |
| EPHA6_HUMAN         | P10415            |
| KS6A1_HUMAN         | Q9NZQ7            |
| CCNE1_HUMAN         | P60568            |
| CCR7_HUMAN          | P49354            |
| SPIN1_HUMAN         | P41229            |
| AKT2_HUMAN          | P25786            |
| MC3R_HUMAN          | Q13177            |
| PPGB_HUMAN          | P16278            |
| ENPP2_HUMAN         | Q09472            |
| HIPK3_HUMAN         | P04629            |
| LT4R2_HUMAN         | Q15750            |
| BCL6_HUMAN          | P42345            |
| MK12_HUMAN          | O15379            |
| COQ8B_HUMAN         | Q13126            |
| ST17A_HUMAN         | Q9Y6M4            |
| KISSR_HUMAN         | Q9HB89            |
| ELOV6_HUMAN         | Q96BR1            |
| CLK2_HUMAN          | P17612            |
| CBLB_HUMAN          | Q969M7            |
| RARG_HUMAN          | P04035            |
| JAK3_HUMAN          | P00390            |
| KS6A2_HUMAN         | P05362            |
| PSB1_HUMAN          | P29350            |
| MTOR_HUMAN          | Q07869            |
| SMS2_HUMAN          | P35968            |
| TPX2_HUMAN          | P10276            |
| FGFR2_HUMAN         | Q8WTS6            |
| ATR_HUMAN           | Q06418            |
| STING_HUMAN         | P53671            |
| FER_HUMAN           | P05771            |
| CAC1D_HUMAN         | P41212            |
| FGF2_HUMAN          | P15104            |
| FKB1B_HUMAN         | P15056            |
| PK3CA_HUMAN         | P36888            |
| FINC_HUMAN          | O14920            |
| GLYM_HUMAN          | P25098            |
| SIR5_HUMAN          | Q9BYW2            |
| CHK2_HUMAN          | P41743            |
| MALT1_HUMAN         | Q9NRM7            |
| IF4E_HUMAN          | P42338            |
| PSN1_HUMAN          | P04233            |

| Protein Name | Uniprot ID |
|--------------|------------|
| METK2_HUMAN  | P27986     |
| CBP_HUMAN    | P40306     |
| HDAC5_HUMAN  | Q9UQL6     |
| GGH_HUMAN    | P55157     |
| TOP2B_HUMAN  | O14733     |
| ADCY4_HUMAN  | P54577     |
| CCRL2_HUMAN  | P35408     |
| YES_HUMAN    | P06280     |
| ENPL_HUMAN   | P06748     |
| SYLC_HUMAN   | Q9NXA8     |
| IL17_HUMAN   | O43570     |
| PDK4_HUMAN   | P36544     |
| HDAC3_HUMAN  | P42684     |
| MARK1_HUMAN  | Q9HBH1     |
| GNPTA_HUMAN  | Q3T906     |
| PI3R5_HUMAN  | P00751     |
| CDK6_HUMAN   | Q15858     |
| ICAM1_HUMAN  | P42356     |
| PLK3_HUMAN   | O75530     |
| SRC_HUMAN    | Q96EB6     |
| TAOK1_HUMAN  | Q8TDS5     |
| AKT1_HUMAN   | Q15910     |
| PDE4D_HUMAN  | P20839     |
| DCLK3_HUMAN  | Q7L7X3     |
| SDHB_HUMAN   | P14625     |
| PSA1_HUMAN   | P01106     |
| TPOR_HUMAN   | O00255     |
| PPARA_HUMAN  | P42226     |
| MYC_HUMAN    | O95622     |
| M3K14_HUMAN  | Q99572     |
| ALK_HUMAN    | P24385     |
| KGP2_HUMAN   | Q05397     |
| IMDH2_HUMAN  | Q9Y5Y6     |
| NMUR1_HUMAN  | Q9NR19     |
| TGFR1_HUMAN  | P09668     |
| TAB1_HUMAN   | Q13470     |
| PDE4A_HUMAN  | O00141     |
| SH2B2_HUMAN  | P18405     |
| CASP6_HUMAN  | P07686     |
| P2RX4_HUMAN  | Q9Y2I1     |
| S29A1_HUMAN  | P36894     |
| KCC1B_HUMAN  | Q9Y6N5     |
| JUN_HUMAN    | Q13526     |
| STK16_HUMAN  | Q9C098     |
| AVR2A_HUMAN  | P22102     |
| BTK_HUMAN    | P16050     |

| <b>Protein Name</b> | <b>Uniprot ID</b> |
|---------------------|-------------------|
| ARBK1_HUMAN         | Q9Y243            |
| DGAT1_HUMAN         | Q86W56            |
| 5HT2B_HUMAN         | Q9UNQ0            |
| ADCY5_HUMAN         | Q99571            |
| CCL2_HUMAN          | Q05655            |
| HMDH_HUMAN          | Q8NFM4            |
| KPCL_HUMAN          | P10619            |
| TGFR2_HUMAN         | Q01469            |
| SMYD2_HUMAN         | P24347            |
| MGMT_HUMAN          | P07339            |
| STAT6_HUMAN         | Q9UF33            |
| IKKA_HUMAN          | P52564            |
| FLT3_HUMAN          | Q92820            |
| 5NTD_HUMAN          | Q13153            |
| ACSA_HUMAN          | P45985            |
| OXER1_HUMAN         | P05177            |
| PP1G_HUMAN          | P60842            |
| PIM1_HUMAN          | P57059            |
| GLNA_HUMAN          | Q9P0L2            |
| EDNRA_HUMAN         | P04439            |
| NMDE1_HUMAN         | Q13822            |
| BAD_HUMAN           | P24864            |
| GRM3_HUMAN          | P51812            |
| RET_HUMAN           | O95067            |
| EST2_HUMAN          | Q12851            |
| ACHB_HUMAN          | P50391            |
| PKN2_HUMAN          | Q05932            |
| ULK3_HUMAN          | O96028            |
| PAK1_HUMAN          | Q99808            |
| MK11_HUMAN          | Q969F8            |
| BGLR_HUMAN          | P29320            |
| NF2L2_HUMAN         | Q06187            |
| MP2K5_HUMAN         | P37088            |
| AEBP2_HUMAN         | Q00987            |
| ERBB2_HUMAN         | P0C869            |
| NLK_HUMAN           | Q9P2J5            |
| LPAR5_HUMAN         | O75608            |
| PTN6_HUMAN          | P0C1S8            |
| FUCO_HUMAN          | O76074            |
| BRAF_HUMAN          | Q9BX63            |
| NOTC1_HUMAN         | P07195            |
| SGMR1_HUMAN         | Q13133            |
| GSHR_HUMAN          | P62937            |
| INCE_HUMAN          | P55055            |
| IDHP_HUMAN          | Q15125            |
| NEK9_HUMAN          | Q9UI33            |



| Protein Name | Uniprot ID |
|--------------|------------|
| CPNS1_HUMAN  | Q05823     |
| KC1G3_HUMAN  | O00481     |
| MK13_HUMAN   | O75716     |
| PSB10_HUMAN  | Q96SW2     |
| NISCH_HUMAN  | Q9ULI0     |
| PGFRA_HUMAN  | P11309     |
| BGAL_HUMAN   | P28066     |
| CNR2_HUMAN   | P04181     |
| CCR4_HUMAN   | P55211     |
| PI4KA_HUMAN  | Q96RR4     |
| KS6A6_HUMAN  | P00734     |
| SOS1_HUMAN   | P41595     |
| CDK4_HUMAN   | P11230     |
| SL9A1_HUMAN  | Q9H5J4     |
| MOGT2_HUMAN  | O00421     |
| ROCK1_HUMAN  | P21912     |
| VGFR3_HUMAN  | P06239     |
| 5HT5A_HUMAN  | P49356     |
| SIN1_HUMAN   | Q9BV86     |
| CDK17_HUMAN  | P04049     |
| ITB6_HUMAN   | Q9UPZ9     |
| ABL1_HUMAN   | Q15375     |
| VIPR2_HUMAN  | Q8TBX8     |
| PI42C_HUMAN  | P25101     |
| RHG35_HUMAN  | O75116     |
| GLYC_HUMAN   | Q16880     |
| HEPS_HUMAN   | P07900     |
| BRD4_HUMAN   | P55212     |
| SL9A3_HUMAN  | Q9BXF3     |
| M3K12_HUMAN  | Q8NHU3     |
| PD1L1_HUMAN  | Q03405     |
| CDK16_HUMAN  | P08172     |
| KC1E_HUMAN   | O75907     |
| THRB_HUMAN   | P04632     |
| KDM5A_HUMAN  | P21554     |
| PTPRB_HUMAN  | P27448     |
| MET_HUMAN    | O14492     |
| FANCJ_HUMAN  | Q96D53     |
| GCR_HUMAN    | P14555     |
| LDHB_HUMAN   | P56192     |
| PE2R4_HUMAN  | P32248     |
| GSTP1_HUMAN  | Q9ULW0     |
| KIT_HUMAN    | P23458     |
| TSPO_HUMAN   | P54753     |
| CCND1_HUMAN  | P34897     |
| CAC1G_HUMAN  | P06756     |

| <b>Protein Name</b> | <b>Uniprot ID</b> |
|---------------------|-------------------|
| AKT3_HUMAN          | P42574            |
| KPCI_HUMAN          | Q07820            |
| ACK1_HUMAN          | P11274            |
| SOAT1_HUMAN         | O60563            |
| MELK_HUMAN          | Q09428            |
| STK24_HUMAN         | Q9UK32            |
| MARK3_HUMAN         | P12931            |
| MP2K7_HUMAN         | Q3SYC2            |
| PCSK6_HUMAN         | P28482            |
| PTN1_HUMAN          | P19634            |
| LSHR_HUMAN          | Q9UBN7            |
| KMT2A_HUMAN         | P43354            |
| H4_HUMAN            | Q13490            |
| CAH12_HUMAN         | Q6P2M8            |
| BRPF3_HUMAN         | Q9H3Y6            |
| PCP_HUMAN           | Q13233            |
| NPY4R_HUMAN         | P22888            |
| LYPA1_HUMAN         | P35222            |
| STK33_HUMAN         | Q9UP38            |
| ATRIP_HUMAN         | P43166            |
| SYIC_HUMAN          | P42785            |
| ACVR1_HUMAN         | P11387            |
| BIRC2_HUMAN         | Q02127            |
| P53_HUMAN           | Q02108            |
| KS6A3_HUMAN         | P25090            |
| I23O1_HUMAN         | Q9Y657            |
| NR1H2_HUMAN         | Q01118            |
| UPAR_HUMAN          | Q13393            |
| CCNT1_HUMAN         | Q86X55            |
| AMPN_HUMAN          | Q8NEV1            |
| PSB6_HUMAN          | Q14790            |
| P2RX7_HUMAN         | Q8TCT8            |
| BCR_HUMAN           | O15151            |
| SCNNA_HUMAN         | O75676            |
| ALDH2_HUMAN         | Q6ZN18            |
| KKCC2_HUMAN         | P40238            |
| FPR2_HUMAN          | O75874            |
| PYRD_HUMAN          | P62942            |
| PSA5_HUMAN          | Q9H4B4            |
| M4K2_HUMAN          | P21397            |
| ACM2_HUMAN          | O96017            |
| IGF1R_HUMAN         | P43405            |
| CP1A2_HUMAN         | Q9NNX6            |
| PA2GA_HUMAN         | P16234            |
| EPHB3_HUMAN         | P20618            |
| WEE1_HUMAN          | P14616            |

| <b>Protein Name</b> | <b>Uniprot ID</b> |
|---------------------|-------------------|
| KAT2A_HUMAN         | P35916            |
| GTR1_HUMAN          | Q9Y616            |
| GCYA1_HUMAN         | O60674            |
| ADHX_HUMAN          | O96013            |
| PCSK5_HUMAN         | P21589            |
| SAE1_HUMAN          | P54750            |
| NR1H3_HUMAN         | P10275            |
| TERT_HUMAN          | P31939            |
| MK06_HUMAN          | Q96Q15            |
| CLK4_HUMAN          | P37231            |
| CAST1_HUMAN         | Q86U86            |
| PTAFR_HUMAN         | Q99436            |
| NPM_HUMAN           | P13500            |
| PK3CB_HUMAN         | P03372            |
| PSB7_HUMAN          | Q96LA8            |
| SMO_HUMAN           | Q13535            |
| EBP_HUMAN           | P21860            |
| SYMC_HUMAN          | P27037            |
| S5A1_HUMAN          | P19367            |
| MK08_HUMAN          | Q96GG9            |
| DAPK3_HUMAN         | P01008            |
| FOLC_HUMAN          | O95822            |
| MK01_HUMAN          | Q9HC29            |
| ADA17_HUMAN         | O14744            |
| PRTN3_HUMAN         | P04798            |
| CBPB2_HUMAN         | Q92979            |
| SGK3_HUMAN          | Q8NFJ6            |
| PTK6_HUMAN          | Q92934            |
| H31_HUMAN           | Q16204            |
| TYRO3_HUMAN         | Q10471            |
| MTAP_HUMAN          | Q15139            |
| CCND3_HUMAN         | P19021            |
| SGK1_HUMAN          | Q92824            |
| SPP2A_HUMAN         | P51679            |
| KGP1_HUMAN          | P08183            |
| EPAS1_HUMAN         | O95551            |
| KPCB_HUMAN          | P55263            |
| ETV6_HUMAN          | Q99527            |
| SUZ12_HUMAN         | Q14432            |
| SETD7_HUMAN         | P17301            |
| B2L11_HUMAN         | Q92843            |
| FGFR4_HUMAN         | Q9NPA2            |
| ARAF_HUMAN          | Q02880            |
| CASP9_HUMAN         | P05981            |
| HG2A_HUMAN          | Q15119            |
| EBPL_HUMAN          | O15111            |

| <b>Protein Name</b> | <b>Uniprot ID</b> |
|---------------------|-------------------|
| FZD1_HUMAN          | P15144            |
| XPP2_HUMAN          | P53355            |
| KS6A4_HUMAN         | Q9UKV0            |
| NCOR2_HUMAN         | Q16678            |
| EPHA7_HUMAN         | Q8WYR1            |
| ROS1_HUMAN          | P68104            |
| GSTO1_HUMAN         | P21802            |
| OGA_HUMAN           | Q8WXE1            |
| ACHA7_HUMAN         | P11766            |
| RARA_HUMAN          | Q07343            |
| RIR1_HUMAN          | Q9ULD4            |
| INSRR_HUMAN         | P53985            |
| MP2K4_HUMAN         | Q8WXR4            |
| HAT1_HUMAN          | Q16288            |
| NEP1_HUMAN          | P42336            |
| NEK6_HUMAN          | Q99700            |
| TNKS1_HUMAN         | Q13163            |
| KPCD_HUMAN          | Q14573            |
| ATD2B_HUMAN         | P42680            |
| BMX_HUMAN           | Q07817            |
| MGLL_HUMAN          | Q13237            |
| AOFA_HUMAN          | Q9BUB5            |
| ARBK2_HUMAN         | Q9Y6E0            |
| PRAP1_HUMAN         | P11166            |
| MKNK1_HUMAN         | P35398            |
| B2CL2_HUMAN         | Q16659            |
| MYO3B_HUMAN         | P35626            |
| PDE3A_HUMAN         | P00533            |
| EGFR_HUMAN          | P24723            |
| IDHC_HUMAN          | P18084            |
| CGT_HUMAN           | Q99558            |
| GRIK1_HUMAN         | P21453            |
| EMAL4_HUMAN         | Q00534            |
| TIF1A_HUMAN         | Q9HC35            |
| SAHH_HUMAN          | P02751            |
| CASP8_HUMAN         | P25788            |
| PUR9_HUMAN          | Q13976            |
| SIK1_HUMAN          | Q14832            |
| DPP2_HUMAN          | Q16654            |
| NCOR1_HUMAN         | P47898            |
| CCNC_HUMAN          | Q07889            |
| BT3A1_HUMAN         | Q8ND76            |
| DEFM_HUMAN          | P09038            |
| EPHA1_HUMAN         | Q9NQU5            |
| CSK21_HUMAN         | P23921            |
| LEG3_HUMAN          | P48735            |

| Protein Name | Uniprot ID |
|--------------|------------|
| EED_HUMAN    | Q14145     |
| CFAB_HUMAN   | P07333     |
| PDE1A_HUMAN  | P22455     |
| CCNE2_HUMAN  | P18848     |
| ERBB3_HUMAN  | P29122     |
| ANM5_HUMAN   | Q07912     |
| VHL_HUMAN    | Q96IY4     |
| HRH4_HUMAN   | P51531     |
| PIN1_HUMAN   | P28715     |
| LATS1_HUMAN  | O94806     |
| KCC1A_HUMAN  | Q96NZ9     |
| SYYC_HUMAN   | Q15349     |
| MDR1_HUMAN   | O43497     |
| PPIA_HUMAN   | P40763     |
| PAK2_HUMAN   | P33261     |
| ROCK2_HUMAN  | P21709     |
| IMDH1_HUMAN  | P22607     |
| ANDR_HUMAN   | P10826     |

**Table S2** Black Sea Cucumbers bioactive compounds acquired from previous wet-lab research.

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| PubChem ID | Canonical SMILES   |
|------------|--|
| 72503      | <chem>CC1(CCCCC2(C1CC=C(C2C=O)C=O)C)C</chem>   |
| 5281224    | <chem>CC1=C(C(CC(C1=O)O)(C)C)C=CC(=CC=CC(=CC=CC=C(C)C=CC=C(C)C=CC2=C(C(=O)C(CC2(C)C)O)C)C)C</chem>                         |
| 10364      | <chem>CC1=C(C=C(C=C1)C(C)C)O</chem>  |
| 3675       | <chem>C1=CC=C(C=C1)CCNN</chem>   |
| 4034       | <chem>CC1=CC(=CC=C1)CN2CCN(CC2)C(C3=CC=CC=C3)C4=CC=C(C=C4)Cl</chem>  |
| 444899     | <chem>CCCCCC=CCC=CCC=CCC=CCCCC(=O)O</chem>   |
| 493570     | <chem>CC1=CC2=C(C=C1C)N(C3=NC(=O)NC(=O)C3=N2)CC(C(C(CO)O)O)O</chem>  |
| 441306     | <chem>CCNC1CC(C(C(C1OC2C(C(C(CO2)(C)O)NC)O)O)OC3C(CC=C(O3)CN)N)N</chem>  |
| 107812     | <chem>C(CS(=O)O)N</chem>   |
| 6912       | <chem>C(C(C(C(CO)O)O)O)O</chem>  |
| 447451     | <chem>CCC1C2(C(C(C(=O)C(CC(C(C(C(=O)C(C(=O)O1)C)C)OC3C(C(CC(O3)C)N(C)C)O)(C)OCC=CC4=CC5=CC=CC=C5N=C4)C)C)NC(=O)O2)C</chem> |
| 441856     | <chem>CC1C(C(C(C(O1)OC2CCC3(C(C2)CCC4C3CCC5(C4(CC(C5C6=CC(=O)OC6)O)O)C)C)O)OC)OC7C(C(C(C(O7)CO)O)O)O</chem>                |
| 2724385    | <chem>CC1C(C(CC(O1)OC2C(OC(CC2O)OC3C(OC(CC3O)OC4CCC5(C(C4)CCC6C5CC(C7(C6(CCC7C8=CC(=O)OC8)O)C)O)C)C)O)O</chem>             |
| 441856     | <chem>CC1C(C(C(C(O1)OC2CCC3(C(C2)CCC4C3CCC5(C4(CC(C5C6=CC(=O)OC6)O)O)C)C)O)OC)OC7C(C(C(C(O7)CO)O)O)O</chem>                |
| 6324616    | <chem>CC1C=CC=C(C(=O)NC2=CC(=C3C(=C2O)C(=C(C4=C3C(=O)C(O4)(OC=CC(C(C(C(C(C1O)C)O)C)OC(=O)C)C)OC)C)O)O)C</chem>             |
| 223253     | <chem>CC12CCC(=O)C=C1CCC3C2C(CC4(C3CCC4(C(=O)COC(=O)CCC5CCCC5)O)C)O</chem>   |
| 5459840    | <chem>CC12CCC3C(=CC(=O)C4C3(CC(C(C4)O)O)C)C1(CCC2C(C)(C(CCC(C)(C)O)O)O)O</chem>  |
| 644073     | <chem>CC(C)(C)C(C)(C1CC23CCC1(C4C25CCN(C3CC6=C5C(=C(C=C6)O)O4)CC7CC7)OC)O</chem>   |
| 36294      | <chem>C1C(C(C(C(C1N)OC2C(C(C(C(O2)CO)O)N)O)O)OC3C(CC(C(O3)CN)O)N)N</chem>  |
| 5284607    | <chem>CC1=C(C(=O)C2=CC=CC=C2C1=O)CC=C(C)CCCC(C)CCCC(C)CCCC(C)C</chem>  |



| PubChem ID | Canonical SMILES  |
|------------|---|
| 56928060   | <chem>CCNC1C(C(C(OC1O)CO)OC2C(C(C(C(O2)CO)O)O)NC(=O)C)OC(C)C(=O)NC(C)C(=O)NC(CC(C=O)NC(CCCCN)C(=O)NC(C)C(=O)O)C(=O)N</chem>         |
| 21593892   | <chem>CC1CC2C3C(CC4(O3)C(CC(CN4)C)C)OC(C1)(O2)CC(=C)C5C(CC(C(O5)(C(C6CC7C(O6)CC(C8(O7)CCC9(O8)C=CCC(O9)C=CCCC(=O)O)C)O)O)C)C</chem> |
| 202225     | <chem>CC1CC(C(C(O1)OC2C(CC3(CO3)C(=O)C(C(C(C(OC(=O)C(C(C2C)OC4CC(C(C(O4)C)OC(=O)C)OC)C)C)OC(=O)C)C)OC(=O)C)N(C)C</chem>             |
| 11953919   | <chem>CC=C(C)C(=O)OC1C(C2(C(CC1(C)C)C3=CCC4C5(CCC(C(C5CCC4(C3(CC2O)C)C)(C)CO)OC6C(C(C(C(O6)C(=O)O)O)O)O)C)COC(=O)C)O</chem>         |
| 6468       | <chem>C1CCC(CC1)(C2=CC=CC=C2)N3CCCCC3</chem>  |
| 1051       | <chem>CC1=NC=C(C(C(=C1O)C=O)COP(=O)(O)O</chem>  |
| 6280       | <chem>CC1CCC2C(C3(C(CC4(C5CCC6C7(C5(CC4(C3CN2C1)O)OC6(C(CC7)OC(=O)C8=CC(=C(C=C8)OC)OC)O)C)O)O)O)(C)O</chem>                         |
| 5280954    | <chem>COC1C(CC2CN3CCC4=C(C3CC2C1C(=O)OC)NC5=C4C=CC(=C5)OC)OC(=O)C=CC6=CC(=C(C(=C6)OC)OC)OC</chem>                                   |
| 5362440    | <chem>CC(C)(C)NC(=O)C1CN(CCN1CC(CC(CC2=CC=CC=C2)C(=O)NC3C(CC4=CC=CC=C34)O)O)CC5=CN=CC=C5</chem>                                     |
| 37768      | <chem>C1C(C(C(C(C1NC(=O)C(CCN)O)OC2C(C(C(C(O2)CO)O)N)O)O)OC3C(C(C(C(O3)CN)O)O)O)N</chem>  |
| 439369     | <chem>CC1C(C(C(O1)OC2C(C(C(C(C2O)O)N=C(N)N)O)N=C(N)N)OC3C(C(C(C(O3)CO)O)O)NC)(CO)O</chem>   |
| 64143      | <chem>CC1=C(C=CC=C1O)C(=O)NC(CSC2=CC=CC=C2)C(CN3CC4CCCCC4CC3C(=O)NC(C)(C)C)O</chem>   |
| 55891      | <chem>CCC(=O)OC(C(C)C)OP(=O)(CCCCC1=CC=CC=C1)CC(=O)N2CC(CC2C(=O)O)C3CCCCC3</chem>   |
| 2131       | <chem>CC[N+](CC)(CCNC(=O)C(=O)NCC[N+](CC)(CC)CC1=CC=CC=C1Cl)CC2=CC=CC=C2Cl</chem>   |
| 3000226    | <chem>CC1C2CCC3(C(C2(CCC1O)C)C(CC4C3(CC(C4=C(CCC=C(C)C)C(=O)O)OC(=O)C)C)O)C</chem>  |
| 17513      | <chem>C1=NC(=C(N1C2C(C(C(O2)CO)O)O)N)C(=O)N</chem>  |
| 5411       | <chem>CCCCNC1=CC=C(C=C1)C(=O)OCCN(C)C</chem>  |
| 4601       | <chem>CC1=CC=CC=C1C(C2=CC=CC=C2)OCCN(C)C</chem>   |
| 6197       | <chem>CC1CC(C(=O)C(C1)C(CC2CC(=O)NC(=O)C2)O)C</chem>  |
| 8955       | <chem>CC(=O)C1CCC2C1(CCC3C2CC=C4C3(CCC(C4)O)C)C</chem>  |
| 28417      | <chem>CC12CCC3C(C1CCC2(C#C)O)CCC4=CC5=C(CC34C)C=NO5</chem>  |
| 64971      | <chem>CC(=C)C1CCC2(C1C3CCC4C5(CCC(C(C5CCC4(C3(CC2)C)C)(C)C)O)C)C(=O)O</chem>  |
| 54675776   | <chem>CC1(C2CC3C(C(=O)C(=C(C3(C(=O)C2=C(C4=C1C=CC=C4O)O)O)O)C(=O)N)N(C)C)O</chem>   |
| 91488      | <chem>CC12CC(C3(C(C1CC(C2(C(=O)CO)O)O)CC(C4=CC(=O)C=CC43C)F)F)O</chem>  |
| 47472      | <chem>C1=CC(=C(C(=C1)Cl)SC(CCC2=CC=C(C=C2)Cl)CN3C=CN=C3)Cl</chem>   |
| 6196       | <chem>CC1=C(C(=NO1)C2=CC=CC=C2)C(=O)NC3C4N(C3=O)C(C(S4)(C)C)C(=O)O</chem>   |
| 2179       | <chem>COC1=C(C=CC(=C1)NS(=O)(=O)C)NC2=C3C=CC=CC3=NC4=CC=CC=C42</chem>   |

Table S3 GO Biological Process analysis results.

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| Term  | Term ID     | P-value     | Adjusted P-value | Old P-value | Old Adjusted P-value | Odds Ratio  | Combined Score | Genes  |
|---|-------------|-------------|------------------|-------------|----------------------|-------------|----------------|--------|
| Positive Regulation Of Myeloid Cell Apoptotic Process | GO:0033034) | 0.001049661 | 0.012721958      | 0           | 0                    | 1665.916667 | 11427.00155    | PIK3CB |
| Sphingosine-1-Phosphate Receptor                      | GO:0003376) | 0.001199554 | 0.012721958      | 0           | 0                    | 1427.857143 | 9603.489235    | PIK3CB |

| Term  | Term ID     | P-value     | Adjusted P-value | Old P-value | Old Adjusted P-value | Odds Ratio  | Combined Score | Genes  |
|---|-------------|-------------|------------------|-------------|----------------------|-------------|----------------|--------|
| Signaling Pathway<br>Positive Regulation Of Leukocyte Apoptotic Process                 | GO:2000108) | 0.001349432 | 0.012721958      | 0           | 0                    | 1249.3125   | 8255.546445    | PIK3CB |
| Negative Regulation Of Vascular Endothelial Growth Factor Signaling Pathway             | GO:1900747) | 0.001349432 | 0.012721958      | 0           | 0                    | 1249.3125   | 8255.546445    | PIK3CB |
| Negative Regulation Of Sprouting Angiogenesis   | GO:1903671) | 0.001499295 | 0.012721958      | 0           | 0                    | 1110.444444 | 7220.954199    | PIK3CB |
| Phosphatidylinositol-3-Phosphate Biosynthetic Process                                   | GO:0036092) | 0.001649143 | 0.012721958      | 0           | 0                    | 999.35      | 6403.334808    | PIK3CB |
| Negative Regulation Of Cellular Response To Vascular Endothelial Growth Factor Stimulus | GO:1902548) | 0.001649143 | 0.012721958      | 0           | 0                    | 999.35      | 6403.334808    | PIK3CB |
| Regulation Of Clathrin-Dependent Endocytosis  | GO:2000369) | 0.002248385 | 0.013490312      | 0           | 0                    | 713.6785714 | 4351.685757    | PIK3CB |
| Regulation Of Rac Protein Signal Transduction   | GO:0035020) | 0.002248385 | 0.013490312      | 0           | 0                    | 713.6785714 | 4351.685757    | PIK3CB |
| Positive Regulation Of Nitric-Oxide Synthase Activity                                   | GO:0051000) | 0.002547917 | 0.013758751      | 0           | 0                    | 624.40625   | 3729.253306    | PIK3CB |
| Regulation Of Vascular Endothelial Growth Factor Signaling Pathway                      | GO:1900746) | 0.002847389 | 0.01397809       | 0           | 0                    | 554.972222  | 3252.888057    | PIK3CB |



| Term  | Term ID     | P-value     | Adjusted P-value | Old P-value | Old Adjusted P-value | Odds Ratio  | Com-bined Score | Gene s |
|---|-------------|-------------|------------------|-------------|----------------------|-------------|-----------------|--------|
| Protein Ned-dylation                                    | GO:0045116) | 0.003296484 | 0.01483418       | 0           | 0                    | 475.6190476 | 2718.11468      | UBE2F  |
| Positive Regu-lation Of Monooxygen-ase Activity         | GO:0032770) | 0.003895069 | 0.015099379      | 0           | 0                    | 399.44      | 2216.110625     | PIK3CB |
| Positive Regu-lation Of Im-mune System Process          | GO:0002684) | 0.004044678 | 0.015099379      | 0           | 0                    | 384.0576923 | 2116.293582     | PIK3CB |
| Regulation Of Nitric-Oxide Synthase Ac-tivity           | GO:0050999) | 0.004194272 | 0.015099379      | 0           | 0                    | 369.8148148 | 2024.379431     | PIK3CB |
| Phosphatidyl-inositol 3-Ki-nase Signaling               | GO:0014065) | 0.004792498 | 0.015320324      | 0           | 0                    | 322.0322581 | 1719.878826     | PIK3CB |
| Regulation Of Sprouting An-giogenesis                   | GO:1903670) | 0.004942017 | 0.015320324      | 0           | 0                    | 311.953125  | 1656.465408     | PIK3CB |
| Platelet Ag-gregation                                   | GO:0070527) | 0.00524101  | 0.015320324      | 0           | 0                    | 293.5735294 | 1541.625367     | PIK3CB |
| Negative Reg-ulation Of Protein Kinase B Signaling      | GO:0051898) | 0.005390484 | 0.015320324      | 0           | 0                    | 285.1714286 | 1489.484609     | PIK3CB |
| Regulation Of Receptor-Me-diated Endo-cytosis           | GO:0048259) | 0.005838817 | 0.015764806      | 0           | 0                    | 262.6184211 | 1350.70617      | PIK3CB |
| Phosphatidyl-inositol Phos-phate Biosyn-thetic Process  | GO:0046854) | 0.006585739 | 0.015848589      | 0           | 0                    | 232.0232558 | 1165.417706     | PIK3CB |
| Regulation Of Cell-Substrate Adhesion                   | GO:0010810) | 0.006585739 | 0.015848589      | 0           | 0                    | 232.0232558 | 1165.417706     | PIK3CB |
| Homotypic Cell-Cell Ad-hesion                           | GO:0034109) | 0.006884403 | 0.015848589      | 0           | 0                    | 221.6888889 | 1103.677423     | PIK3CB |
| Post-Transla-tional Protein Modification                | GO:0043687) | 0.007183008 | 0.015848589      | 0           | 0                    | 212.2340426 | 1047.595101     | UBE2F  |
| Positive Regu-lation Of Ras Protein Signal Transduction | GO:0046579) | 0.007630802 | 0.015848589      | 0           | 0                    | 199.47      | 972.5284118     | PIK3CB |
| Negative Reg-ulation Of                                 | GO:0043407) | 0.007630802 | 0.015848589      | 0           | 0                    | 199.47      | 972.5284118     | PIK3CB |

| Term  | Term ID     | P-value     | Adjusted P-value | Old P-value | Old Adjusted P-value | Odds Ratio  | Combined Score | Genes  |
|---|-------------|-------------|------------------|-------------|----------------------|-------------|----------------|--------|
| MAP Kinase Activity                                   |             |             |                  |             |                      |             |                |        |
| Phosphatidylinositol-Mediated Signaling Regulation Of | GO:0048015) | 0.009271564 | 0.018543128      | 0           | 0                    | 163.4098361 | 764.8892871    | PIK3CB |
| Cell-Matrix Adhesion                                  | GO:0001952) | 0.00971873  | 0.018743266      | 0           | 0                    | 155.7265625 | 721.5902191    | PIK3CB |

**Table S4** KEGG Pathway analysis results.

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| Term                                      | P-value  | Adjusted P-value | Old P-value | Old Adjusted P-value | Odds Ratio  | Combined Score | Genes  |
|---|----------|------------------|-------------|----------------------|-------------|----------------|--------|
| Aldosterone-regulated sodium reabsorption | 0.00554  | 0.034881         | 0           | 0                    | 277.236111  | 1440.455       | PIK3CB |
| Type II diabetes mellitus                 | 0.006884 | 0.034881         | 0           | 0                    | 221.688889  | 1103.677       | PIK3CB |
| Carbohydrate digestion and absorption     | 0.007034 | 0.034881         | 0           | 0                    | 216.8586957 | 1074.977       | PIK3CB |
| Regulation of lipolysis in adipocytes     | 0.008228 | 0.034881         | 0           | 0                    | 184.6574074 | 886.4026       | PIK3CB |
| Endometrial cancer                        | 0.008675 | 0.034881         | 0           | 0                    | 174.9122807 | 830.3601       | PIK3CB |
| VEGF signaling pathway                    | 0.008824 | 0.034881         | 0           | 0                    | 171.887931  | 813.0729       | PIK3CB |
| GnRH secretion                            | 0.00957  | 0.034881         | 0           | 0                    | 158.2063492 | 735.5258       | PIK3CB |

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