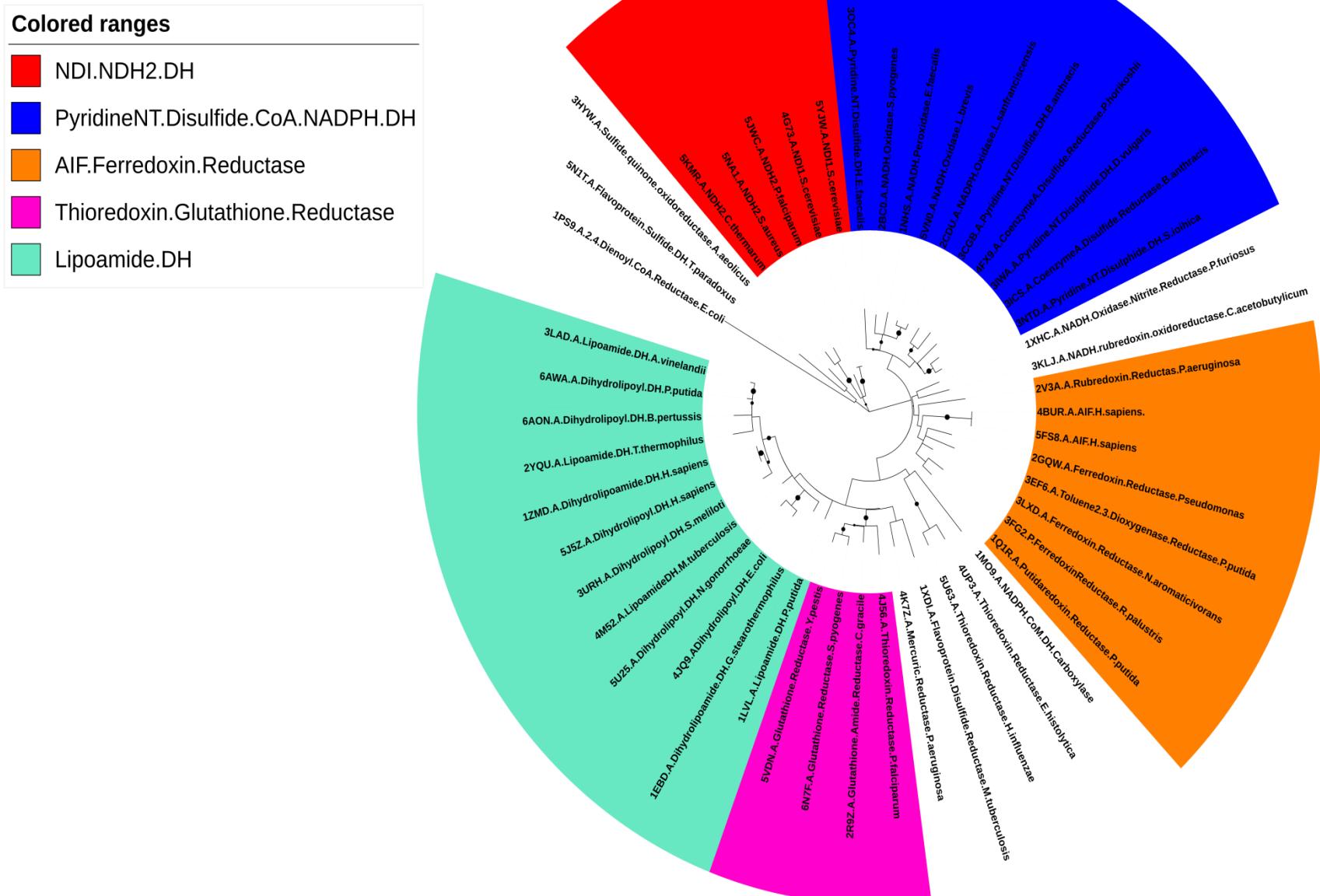


## Supp. Fig. 1

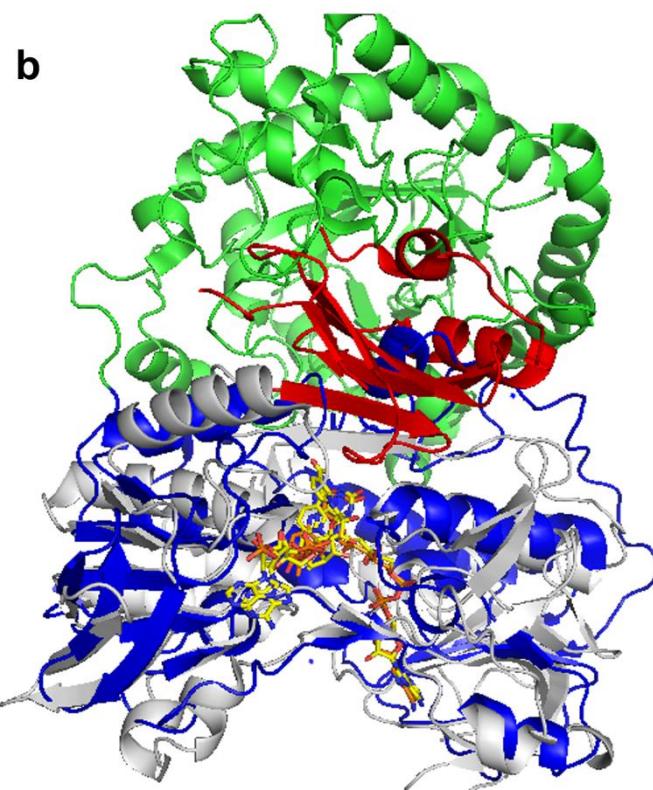
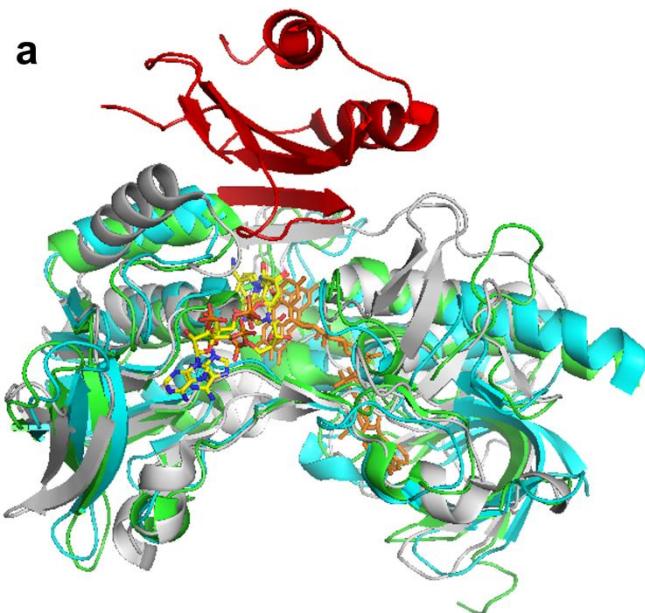
**Tree scale: 1**



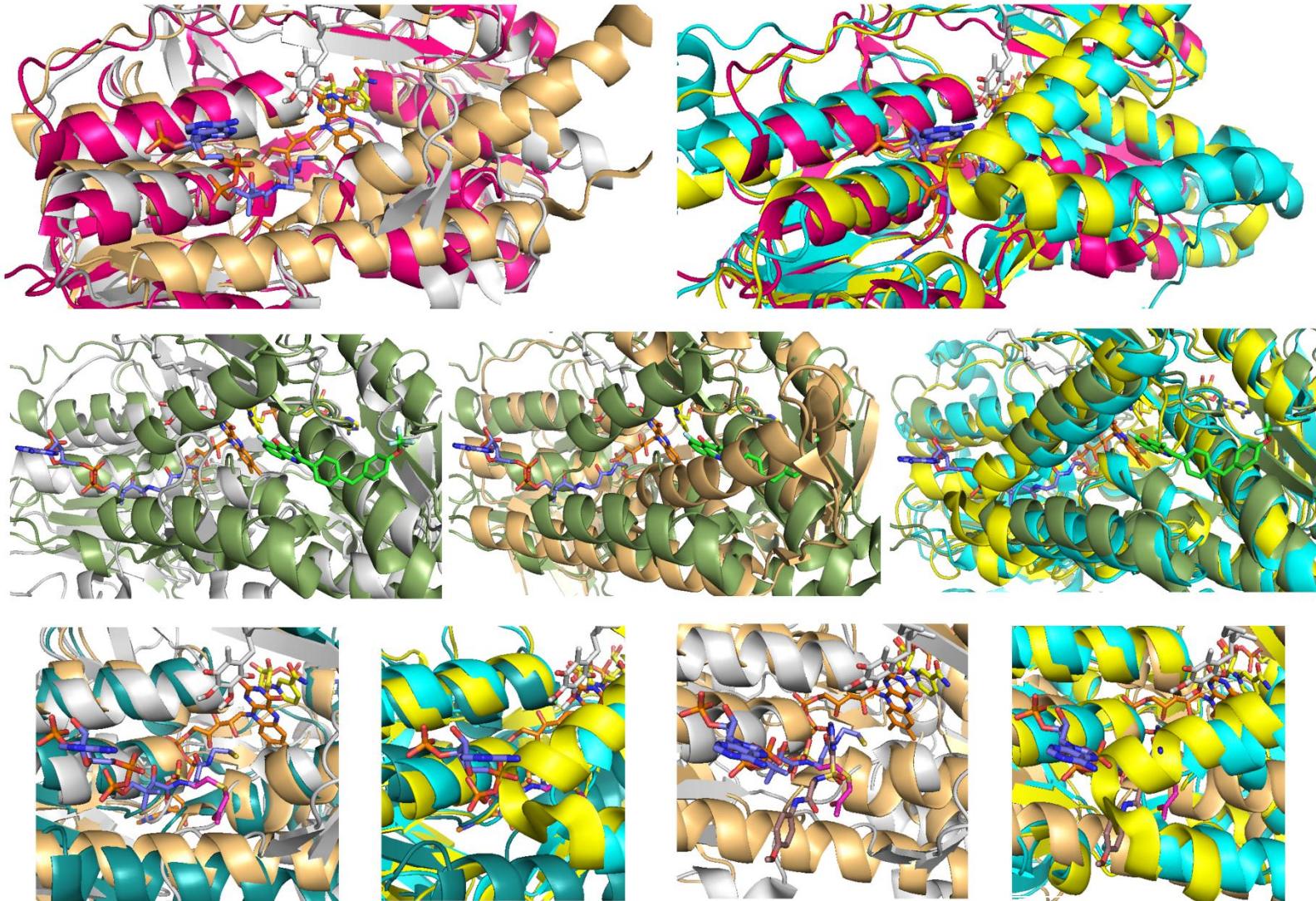
## Supp. Fig. 2

N_P_004199_Homo_sapiens_Af	334	F_RIG_WMMK1	343	V_VAA_VAA	394	I_IWAVAV	438	RRR_VH_HHVVAV	462	482	F_WSLFLP_VVYVA	494
4B1_A.Phaeoptilis	233	F_RIG_WMMK1	241	293	V_VAA_VAA	297	RRR_VH_HHVVAV	360	482	F_WSLFLP_VVYVA	392	
232_A.NADH_CoQH2_reductase	232	F_RIG_WMMK1	240	293	V_VAA_VAA	297	RRR_VH_HHVVAV	360	482	F_WSLFLP_VVYVA	392	
19_A.NADH_Oxidase_Ltrevis	257	A_AMA_VIP	256	293	V_VAA_VAA	314	RRR_VH_HHVVAV	360	482	F_WSLFLP_VVYVA	392	
19_A.CADN_Oxidase_Ltrevis	171	L_HLRLMFL	180	237	C_AAI	231	263	V_VAA_VAA	320	341	A_YIYLPLATLA	354
28C0_A.NADH_Oxidase_Spyogenes	224	UVV_VCL	233	284	I_VAA_VAA	288	321	V_VAA_VAA	326	374	I_IABA_TAAAGM	287
22GUA_NADPH_Oxidase_L.sanfranciscensis	179	A_RVLYX	188	240	I_LCI	244	277	I_FAVAV	282	264	K_YIYLPLATLA	351
1NHS_A.NADH_Peroxidase_E.faecalis	179	I_LLRLVEV	188	239	V_VAA_VAA	243	276	F_FAIVF	281	293	K_YIYLPLATLA	306
3LXD_A.Ferredoxin_Reductase_N_aromaticovorans	182	ALV_PFLARV	191	244	V_VII	248	286	V_VAA_VAA	285	298	V_VIYRL_VVANRMA	311
3F2G_P.Ferrodoxin_Reductase_P.alcalifaciens	172	BLAR_VMVAR	181	234	V_VVI	238	270	I_SAII	193	275	B_MVRV_VVORATVA	300
25QW_A.Ferrodoxin_Reductase_Pseudomonas	175	T_GPLMSRA	184	232	V_VII	236	266	V_VAA_VAA	273	285	FERTVTSVSAQDQ	298
12_A.S.Arbrobacter_Reductase_P.aeruginosa	175	A_CGCVMPML	184	235	V_VAA_VAA	240	272	I_VAVV	277	277	LYVFLMLACARALA	300
3KLJ_A.NADH_nubredoxin_oxireductase_Cacetobutylicum	175	A_CGCVMPML	184	234	V_VAA_VAA	240	266	I_VAVV	265	271	B_KHGSLLINIAKQK	284
3F6G_A.Toluene_2,3-Dioxogenase_Reductase_P.putida	173	A_GASLLVVR	182	234	L_VAVV	238	276	F_FAIVF	275	286	RBSLTLTMAALQ	299
19_A.Ptulardosein_Reductase_P.putida	179	A_RVLYX	188	243	I_AII	247	277	I_MAVAV	281	299	MVWV_VVUVALDQ	309
30C4_A.Pyridine_Dihydro_DH.E.faecalis	177	BLAR_VMVAR	186	237	F_ALA	241	276	I_VAVV	271	261	Y_VAVV_VVLUVVA	294
31_A.Pyridine_ND.Thioplylde_DH.vulgaris	160	LAQ_OIM	169	251	I_OAI	265	269	F_FAIVF	284	304	P_VAVV_VVPLMAM	319
30_A.Pyridine_ND.Thioplylde_DH.vulgaris	160	LAQ_OIM	169	251	I_OAI	265	270	I_VAVV	274	305	PLVPLV_VVPLMAM	314
4F9A_A.Coenzyme_A_oxidase_Reductase_P.hokinoshii	181	V_VVI	189	240	I_LAI	244	278	V_VAA_VAA	283	265	B_WVPLWLAABHNN	308
3CS_A.Coenzyme_A_oxidase_Reductase_B.anthracis	217	MAN_VVM	225	275	I_LAI	279	313	I_VAVV	318	330	M_VIPLWLAABHNN	343
3NTD_A.Pyridine_NT.Thioplylde_DH.S.loitaca	181	LAQ_VMV	189	260	I_MAI	264	264	I_VAVV	303	315	A_CLVPLWLAABHNN	328
5HM_P.ANDH2_C.thamnos	198	A_VVLL	207	257	V_VVI	261	266	I_VIVV	269	311	F_VVFTADIAIICHL	324
5H17_A.Vlaproflavene_Sulfide_DH.T.paradoxus	213	KHH_FPKFL	222	277	R_QVQ	281	320	I_VIVV	312	323	FFAANSGVQVCAA	349
5H41_A.NDH2_S.aureus	207	A_PMLPMLP	216	266	W_VAA	270	303	I_VIVV	308	320	FPTTAA_IMAOQG	333
5JWC_A.NDH2_F.pelliciparum	232	W_VVLLPFL	241	294	W_VAA	286	337	I_VIAI	342	363	PNNLNTS_ALAKLQ	376
5JWD_A.NDH2_F.pelliciparum	181	I_VVLLPFL	194	240	M_MP	253	267	F_FAIVF	294	301	WVNV_VVMMI	321
4F73_A.NDT_S.cerevitaee	261	ALI_VLVLNM	270	323	I_WAT	322	367	I_VAVV	372	377	BLPLT_VAVGQAL	390
5JW_A.NDT_S.cerevitaee	243	ALI_VLVLNM	255	307	I_WAT	311	344	I_VAVV	354	355	BLPLT_VAVGQAL	372
4N52_A.Lipoamide_DH.M.tuberculosis	203	F_RFL_AL	211	268	I_AII	270	304	I_VAVV	325	323	ADVWV_VVAVIA	338
4N53_A.Lipoamide_DH.M.tuberculosis	216	AMM_FFLA	224	260	V_VVI	264	305	I_VAVV	325	357	WVAV_VVAVIA	352
4QD_A.Dihydroxyacetone_P._Denitrificans	205	UVV_VCL	213	269	V_VVI	272	308	I_VAVV	323	295	V_VAV_VVAVIA	338
46AW_A.Dihydroxyacetone_DH.P.putida	214	F_RFL_AL	222	277	I_VAVV	281	317	V_VAA	322	334	E_VIVM_VVIFH	347
6D25_A.Dihydroxyacetone_DH.gonorrhoeae	334	MMF_LH	342	398	V_VAA	402	432	I_VAVV	443	465	M_VVVAIALC	469
5J52_A.Dihydroxyacetone_DH.Sphaerotilis	230	F_FLHV_VBV	239	297	L_VCI	301	337	I_VAVV	342	354	F_FIIII_VVIMAR	367
23MD_A.Dihydroxyacetone_DH.H.sphaerotilis	208	F_FLHV_VBV	217	275	L_VCI	279	315	I_VAVV	320	332	F_FIIII_VVIMAR	345
3URH_A.Dihydroxyacetone_DH.s.melliloti	228	FLF_VIL	236	293	L_IAT	297	333	V_VAA_VAA	338	355	E_VAV_VVAVIA	363
1LVL_A.Lipoamide_DH.P.putida	201	BAR_VLIL	209	261	V_VVI	265	300	W_VAA	305	317	MAC_EMVIA	330
1BED_A.Dihydroxyacetone_DH.G.stethophyllum	200	CGA_VILS	208	263	C_VV	267	303	I_FAVAV	308	320	Y_VVVAIA	333
ZQUY_A.Lipoamide_DH.T.hermophilus	197	Y_VMLI	205	257	V_VVI	261	297	I_VAVV	302	314	I_VAVV_VVAVIA	327
3LAD_A.Lipoamide_DH.A.vinelandii	210	AMM_FFLA	218	273	V_VVI	277	317	V_VAA	318	334	E_VIVM_VVIFH	343
29Z2_A.Glutathione_Amide_Reductase_C.gracile	199	ALR_FFLC	204	257	I_WAV	261	299	V_VAA	302	314	AAVRRLA_RLF	327
6W7F_A.Glutathione_Reductase_S.pyogenes	200	F_RFL_AL	206	261	W_IAI	268	304	I_VAVV	306	316	AAVRRLA_RLF	331
5WV_A.Glutathione_Reductase_Yepth	205	W_VVLL	214	271	W_IAI	275	311	V_VAA	312	328	Y_VVVAIALC	341
21_VRHAL_R	219	W_VVLL	227	303	I_FAVAV	325	332	I_FAVAV	325	342	Y_VVVAIALC	375
1D17_A.Polyprotein_Estherase_P.mutabile	211	W_VVLL	220	272	L_MII	276	312	I_FAVAV	317	329	AMF_EIAMIYH	342
1MOB_A.NADH_CoH_Dcarboxylase	243	L_VRL_VLL	252	307	F_VEL	311	348	V_VAA	353	367	Y_VVVAIALC	362
4K72_A.Mercaptide_Reductase_P.aeruginosa	204	VLAR_VLFL	213	264	V_VVI	268	308	I_FAVAV	303	321	AAV_VVYF	365
4UP3_A.Thiooxidorein_Reductase_E.histolytica	179	I_HLRL_VAF	188	243	F_YAI	247	279	F_VCA	284	297	AAV_MALC	310
5W63_A.Thiooxidorein_Reductase_Hinfluenzae	176	H_LHRL_VAF	186	243	F_VAI	247	284	F_VCA	280	307	AAV_MALC	315
1PS9_A.2,4-Dienol_GoA.Reductase_E.coli	321	SAC_GAC	330	401	L_FAI	405	447	V_VAA	452	497	FPTTAA_IMAOQG	480
1PS9_A.2,4-Dienol_GoA.Reductase_E.coli	321	SAC_GAC	330	401	L_FAI	405	447	V_VAA	452	527	F_CFWV_VVLLQ	539

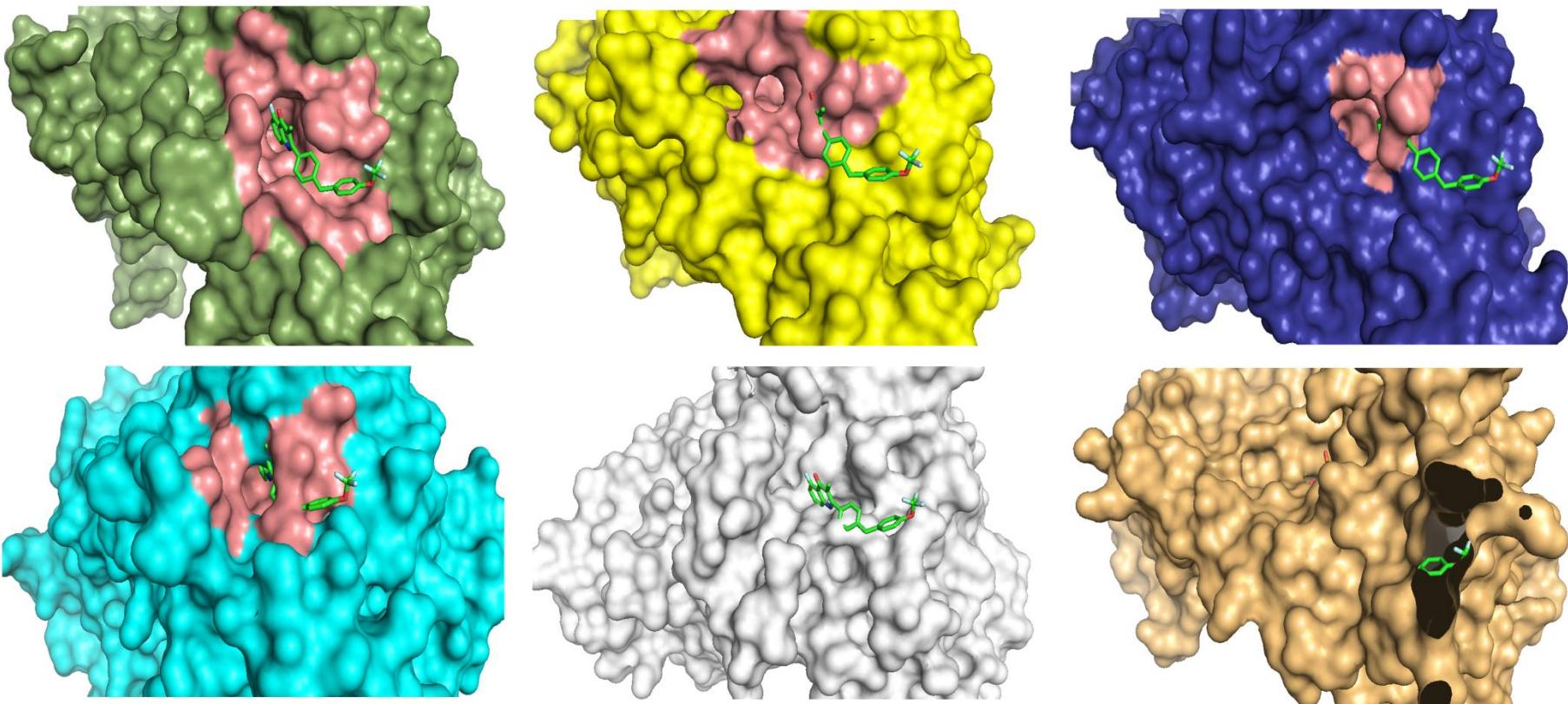
Supp. Fig. 3



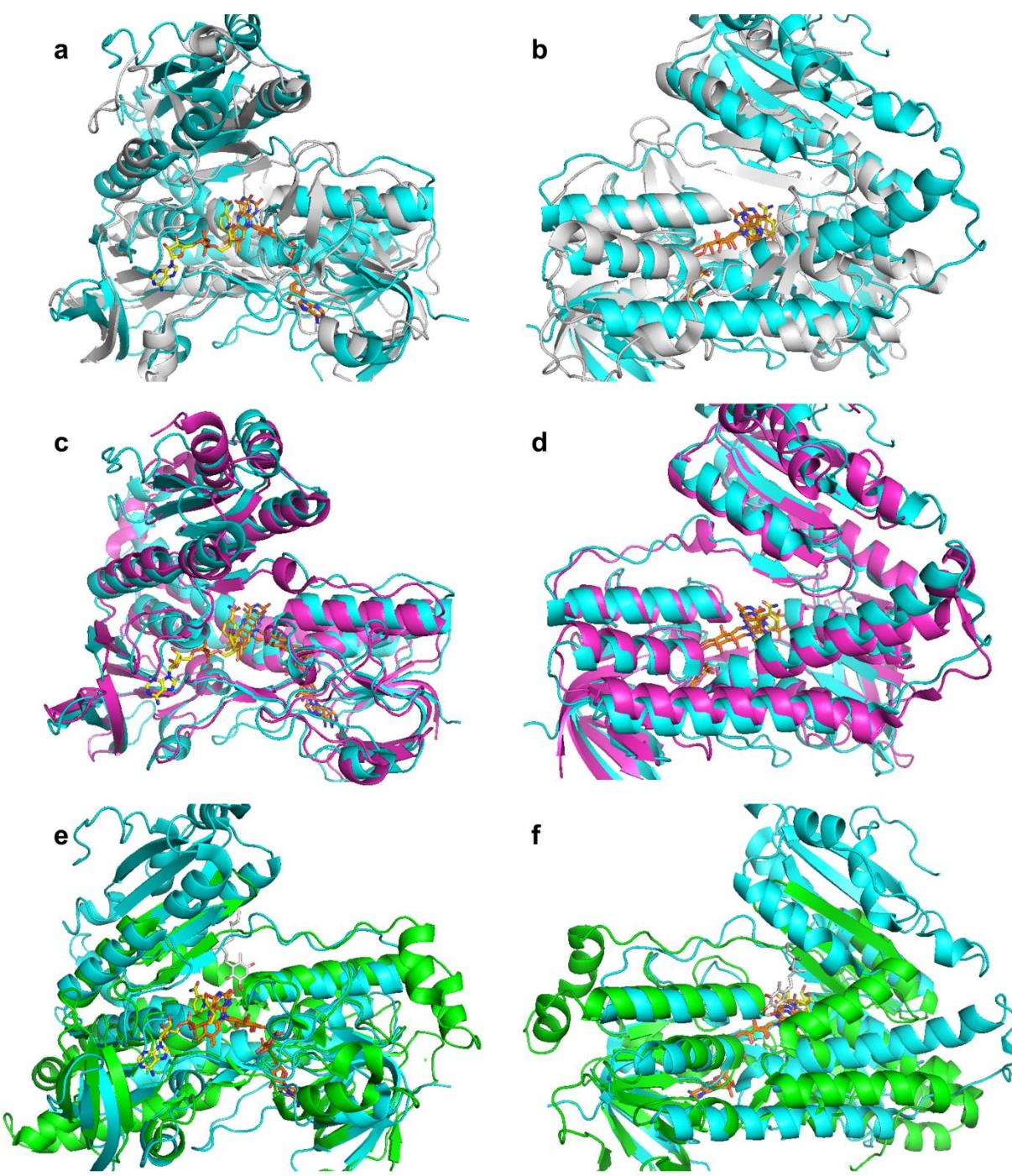
Supp. Fig. 4



Supp. Fig. 5

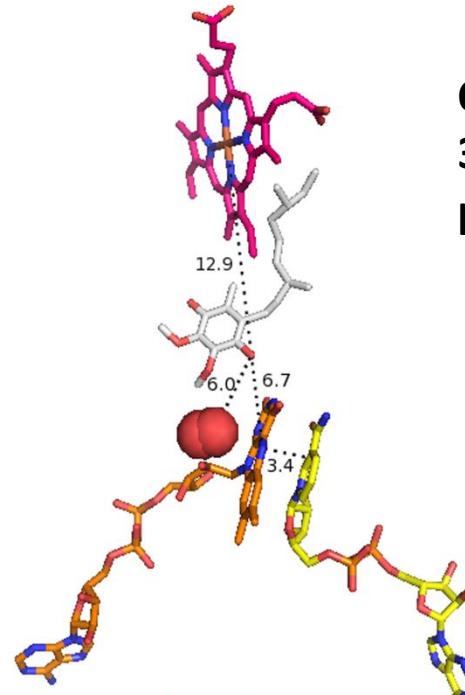
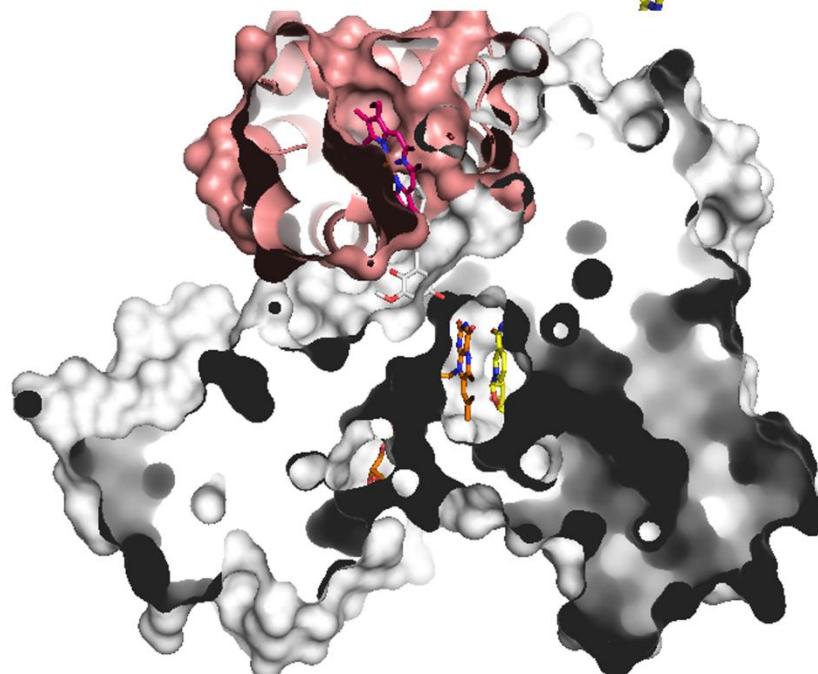
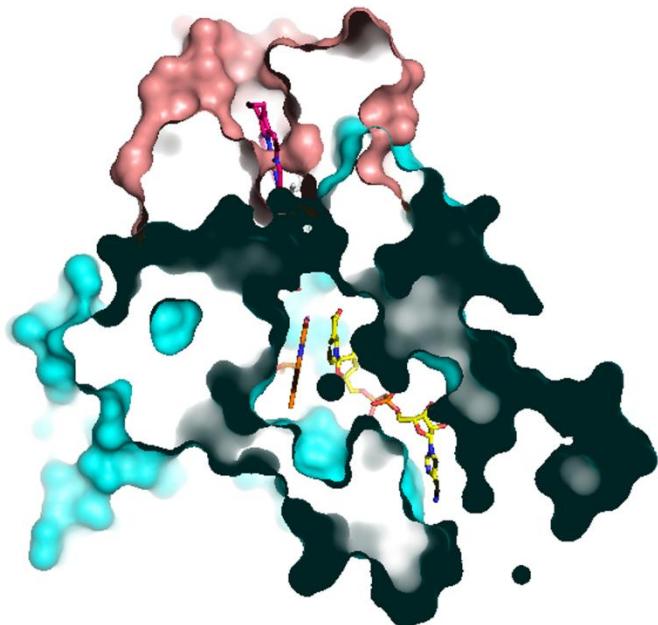
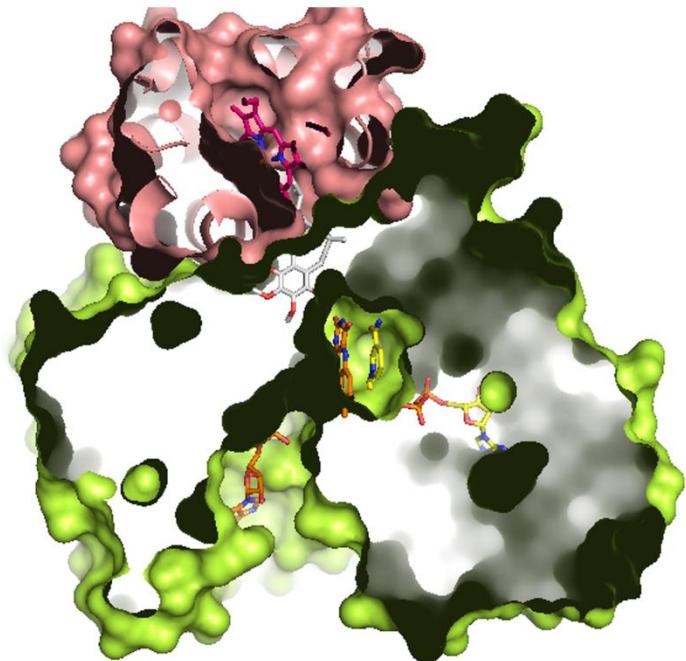


Supp. Fig. 6

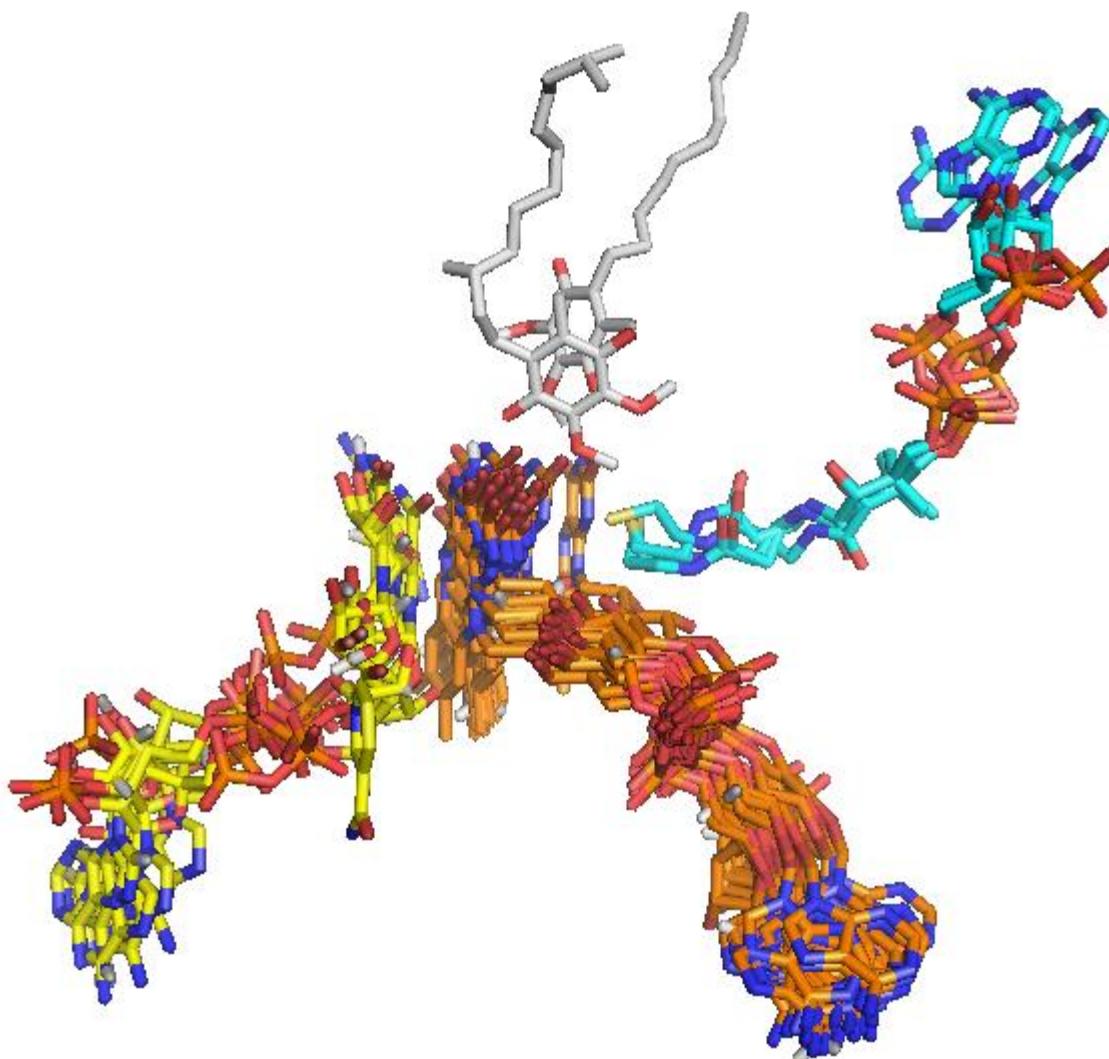




Alternative  
Fig. 6



Oxygen from  
3hyw.pdb to be  
put here?



Alternative Panel D for  
Fig. 5; O<sub>2</sub> (5vn0.pdb) or  
H<sub>2</sub>S (3hyw.pdb) here?