Dataset S1. Characterization of SOD1 trimer interfaces.
Stars indicate residues at which a disease-associated mutation exists. A residue is involved in the monomer-monomer interface if any atom (not including hydrogens) is within 4.5 Å of any atom (not including hydrogens) of a residue from another monomer. We calculated interface interaction energies with and without van der Waals repulsion energy using the Medusa force field (Ding, F., Dokholyan, N. V. *PLoS Comput. Biol.* 2:e85). Residue numbers listed are interacting on either one or both monomers in the given monomer-monomer interface.

MODEL 1

	Monomer 2	Monomer 3
Monomer 1	**Residues involved:** 23 24 25 27 28 29 30 31 33 34 37* 38* 41* 42 44 45* 46* 47 48* 49 51 52 53 56 57 58 61 62 64 65* 66 67 68 69 73 74 75 76* 77 78 79 95* 99 101* 102 103 104* 105* 106* 108 109 110 111* 112* 114* 115* 116 117 118* 119 121 125* 130 131 132 133* 134* 135 148* 150 152 **Interface interaction energy:** -175 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -184 kcal/mol **Interface area:** 2285 Å^2	**Residues involved:** 2 52 53 63 65* 66 67 68 120 135 136 138 141* 147* **Interface interaction energy:** -37 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -38 kcal/mol **Interface area:** 743 Å^2
Monomer 2	X	**Residues involved:** 1 2 4* 5 6* 7* 8* 10* 12* 13 16* 17 18 19* 20* 21* 22* 23 24 25 28 31 33 34 35 42 44 47 48* 56 62 65* 66 67 68 69 70 73 77 78 93* 95* 96 98 108 109 111* 114* 116 117 118* 119 120 121 124* 127* 145* 148* **Interface interaction energy:** -145 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -150 kcal/mol **Interface area:** 2182 Å^2

MODEL 2

	Monomer 2	Monomer 3
Monomer 1	**Residues involved:** 150 **Interface interaction energy:** -3 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -3 kcal/mol **Interface area:** 56 Å^2	**Residues involved:** 1 2 6 7* 8* 21* 22* 23 25 27 28 48* 49 51 52 57 58 61 62 63 64 125* 135 136 141* 142 143 145* 147* 150 152 **Interface interaction energy:** -83 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -84 kcal/mol **Interface area:** 1472 Å^2
Monomer 2	X	**Residues involved:** 1 2 4* 5 6 7* 10* 12* 13 14 16* 17 18 19* 20 21* 22* 27 28 29 30 31 33 34 37* 48* 49 52 53 56 57 58 63 64 65* 66 67 68 76* 80 93* 95* 96 97 108 109 110 112* 114* 115* 116 117 118* 130 131 132 133 134* 135 136 141* 142 143 145* 147* 148* 150 152 **Interface interaction energy:** -150 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -156 kcal/mol **Interface area:** 2321 Å^2

MODEL 3

	Monomer 2	Monomer 3
Monomer 1	**Residues involved:** 53 66 67 **Interface interaction energy:** -2 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -2 kcal/mol **Interface area:** 81 Å^2	**Residues involved:** 1 2 4* 5 6 7* 10* 12* 13 14 16* 17 18 19* 20 21* 22* 23 25 28 29 30 31 37* 42 47 48* 49 51 52 53 56 57 98 99 105* 112* 113 114* 115* 116 118* 120 141* 142 143 145* 147* 148* 150 152 **Interface interaction energy:** -153 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -161 kcal/mol **Interface area:** 2008 Å^2
Monomer 2	X	**Residues involved:** 17 19* 22* 45 48* 49 52 53 56 57 58 61 62 63 64 65* 66 67 68 69 70 76* 77 78 82 106* 123 124* 127* 131 132 133 134* 135 136 138 142 145* **Interface interaction energy:** -69 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -70 kcal/mol **Interface area:** 1381 Å^2

MODEL 4

	Monomer 2	Monomer 3
Monomer 1	**Residues involved:** 49 51 52 53 56 57 67 69 70 **Interface interaction energy:** -10 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -11 kcal/mol **Interface area:** 336 Å^2	**Residues involved:** 39 44 46* 47 48* 49 51 52 53 56 57 61 62 63 64 66 68 127* 135 **Interface interaction energy:** -52 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -54 kcal/mol **Interface area:** 729 Å^2
Monomer 2	X	**Residues involved:** 1 2 4* 5 6 7* 8* 10* 12* 13 14 16* 17 18 19* 20 21* 22* 23 24 25 27 28 31 35 37* 41* 44 45 46* 48* 49 56 58 63 65* 66 67 70 73 74 75 78 79 80 82 83 86 87 89 90 91 93* 95* 96 97 98 99 100 101* 102 103 104* 105* 106* 108 109 110 111 112* 114* 115* 116 117 118* 119 120 121 123 125* 127* 131 132 135 136 142 143 145* 147* 148* 150 152 **Interface interaction energy:** -377 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -393 kcal/mol **Interface area:** 4942 Å^2

MODEL 5

	Monomer 2	Monomer 3
Monomer 1	**Residues involved:** 1 2 4* 8* 10* 12* 13 14 20 49 51 52 53 56 61 95* 96 103 105* 108 109 110 111 112* 114* 115* 138 142 143 145* 147* 148* 150 152 **Interface interaction energy:** -105 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -110 kcal/mol **Interface area:** 1634 Å^2	**Residues involved:** 2 49 52 56 57 58 112* 138 141* 142 143 147* 148* **Interface interaction energy:** -32 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -33 kcal/mol **Interface area:** 554 Å^2
Monomer 2	X	**Residues involved:** 1 2 4* 5 6 7* 8* 10* 12* 13 14 17 18 19* 20 21* 22* 23 24 25 27 28 29 30 31 33 34 35 37* 38* 39 41* 42 44 45 46* 47 48* 49 52 53 56 57 63 64 65* 73 74 75 76* 77 78 79 80 83 85 86 87 89 90 91 93* 95* 96 97 98 99 100 101* 102 103 104* 105* 106* 108 109 110 111 112* 114* 115* 116 117 118* 119 120 121 141* 143 145* 147* 150 152 **Interface interaction energy:** -258 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -272 kcal/mol **Interface area:** 3795 Å^2

MODEL 6

	Monomer 2	Monomer 3
Monomer 1	**Residues involved:** 7* 12* 13 14 16* 17 18 20 21* 25 27 28 29 30 31 33 34 39 41* 42 44 45 46* 47 48* 49 51 57 58 61 62 65* 74 75 76* 77 78 79 80 83 85 86 **Interface interaction energy:** -95 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -102 kcal/mol **Interface area:** 1612 Å^2	**Residues involved:** 1 2 4* 5 6 7* 8* 12* 13 14 17 18 19* 20 21* 22* 23 24 25 27 28 29 30 31 34 44 **Interface interaction energy:** -61 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -65 kcal/mol **Interface area:** 913 Å^2
Monomer 2	X	**Residues involved:** 1 2 4* 5 6 7* 8* 12* 13 14 16* 17 18 19* 20 21* 22* 24 27 28 29 30 31 33 34 35 37* 38* 39 41* 42 44 45 46* 47 49 51 61 62 63 64 66 67 68 69 70 77 80 82 83 85 86 87 89 90 91 93* 95* 96 97 98 99 100 101* 102 103 104* 105* 106* 108 109 110 112* 114* 115* 116 117 118* 119 120 124* 125* 127* 130 131 132 133 134* 135 136 141* 142 143 145* 147* 148* 150 152 **Interface interaction energy:** -316 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -333 kcal/mol **Interface area:** 4419 Å^2

MODEL 7

	Monomer 2	Monomer 3
Monomer 1	**Residues involved:** 42 44 46* 47 49 51 52 53 57 61 62 63 64 70 78 83 85 87 123 127* 133 135 **Interface interaction energy:** -46 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -47 kcal/mol **Interface area:** 811 Å^2	**Residues involved:** 2 4* 6 8* 10* 12* 13 14 16* 18 33 35 46* 47 48* 49 51 52 83 89 93* 95* 99 103 105* 108 109 110 111 112* 114* 135 147* 150 152 **Interface interaction energy:** -71 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -76 kcal/mol **Interface area:** 1433 Å^2
Monomer 2	X	**Residues involved:** 1 2 8* 12* 13 14 16* 17 18 19* 20 21* 22* 23 24 25 27 28 29 30 31 33 34 35 37* 38* 39 41* 42 44 45 46* 47 48* 51 52 53 61 62 67 68 77 78 79 80 82 83 85 86 87 89 90 91 93* 95* 96 97 98 104* 108 109 110 111 112* 114* 116 117 118* 119 120 121 123 124* 125* 127* 130 131 132 133 141* 142 143 145* 147* 148* 150 152 **Interface interaction energy:** -254 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -264 kcal/mol **Interface area:** 3710 Å^2

MODEL 8

	Monomer 2	Monomer 3
Monomer 1	**Residues involved:** 4* 5 6 7* 8* 12* 13 14 17 31 37* 39 41* 42 44 45 46* 47 48* 49 51 52 53 56 57 58 61 62 63 64 65* 66 67 68 69 74 75 78 85 86 87 89 142 143 147* 150 152 **Interface interaction energy:** -108 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -112 kcal/mol **Interface area:** 1643 $Å^2$	**Residues involved:** 1 2 4* 5 6 7* 8* 12* 13 14 16* 17 19* 23 24 25 27 28 29 30 31 33 34 35 37* 38* 39 41* 42 44 45 46* 47 48* 49 51 62 63 64 65* 66 69 70 78 80 83 85 86 89 91 93* 95* 96 97 98 99 101* 103 105* 106* 108 110 111 112* 114* 115* 116 117 118* 119 120 121 123 124* 125* 127* 130 132 135 136 141* 142 143 145* 147* 148* 150 152 **Interface interaction energy:** -284 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -300 kcal/mol **Interface area:** 4107 $Å^2$
Monomer 2	X	**Residues involved:** 1 2 4* 5 7* 14 17 19* 41* 42 48* 49 56 57 64 66 67 99 100 101* 102 103 104* 105* 111 114* 115* 147* 148* 150 152 **Interface interaction energy:** -62 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -65 kcal/mol **Interface area:** 1068 $Å^2$

MODEL 9

	Monomer 2	Monomer 3
Monomer 1	**Residues involved:** 25 27 28 29 30 31 33 49 51 52 53 62 63 64 65* 66 67 68 69 70 73 85 91 118* 119 120 121 123 125* 127* 130 134* 135 143 **Interface interaction energy:** -63 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -67 kcal/mol **Interface area:** 1186 Å^2	**Residues involved:** 27 28 45 47 48* 49 52 53 103 104* 108 109 110 111 112* **Interface interaction energy:** -31 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -32 kcal/mol **Interface area:** 557 Å^2
Monomer 2	X	**Residues involved:** 1 2 4* 5 6 7* 8* 10* 12* 13 14 16* 17 18 19* 20 21* 22* 23 24 25 27 28 29 31 33 34 35 37* 38* 41* 42 44 45 46* 47 48* 49 51 56 57 58 62 63 64 65* 66 67 68 69 70 73 74 75 76* 77 78 79 80 82 83 85 86 95* 96 97 98 99 101* 102 103 104* 105* 112* 114* 115* 117 125* 130 131 132 133 138 141* 142 143 145* 147* 148* 150 152 **Interface interaction energy:** -355 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -370 kcal/mol **Interface area:** 4478 Å^2

MODEL 10

	Monomer 2	Monomer 3
Monomer 1	**Residues involved:** 1 2 4* 5 8* 14 16* 18 19* 23 24 25 27 28 29 31 35 41* 42 44 45 46* 47 48* 49 51 52 85 86 87 89 90 95* 96 98 100 118* 119 120 121 147* 148* 150 **Interface interaction energy:** -77 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -81 kcal/mol **Interface area:** 1551 Å^2	**Residues involved:** 1 2 4* 6 7* 8* 10* 12* 13 14 16* 17 18 19* 20 21* 28 29 30 31 33 34 35 37* 38* 42 46* 48* 49 52 53 56 78 80 83 85 89 103 108 109 110 111 112* 114* 115* 117 118* 119 124* 127* 131 133 134* 135 136 138 143 147* 150 152 **Interface interaction energy:** -170 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -176 kcal/mol **Interface area:** 2843 Å^2
Monomer 2	X	**Residues involved:** 1 2 4* 5 7* 8* 10* 12* 13 14 16* 17 18 19* 21* 25 27 28 29 30 31 33 34 35 37* 38* 39 41* 42 44 45 46* 47 48* 49 51 52 53 56 58 61 62 63 64 65* 66 68 70 82 83 86 91 93* 95* 96 97 98 99 100 101* 102 103 104* 105* 106* 108 109 110 111 112* 114* 116 135 141* 143 145* 147* 148* 150 152 **Interface interaction energy:** -257 kcal/mol **Interface interaction energy, no van der Waals repulsion:** -269 kcal/mol **Interface area:** 3616 Å^2