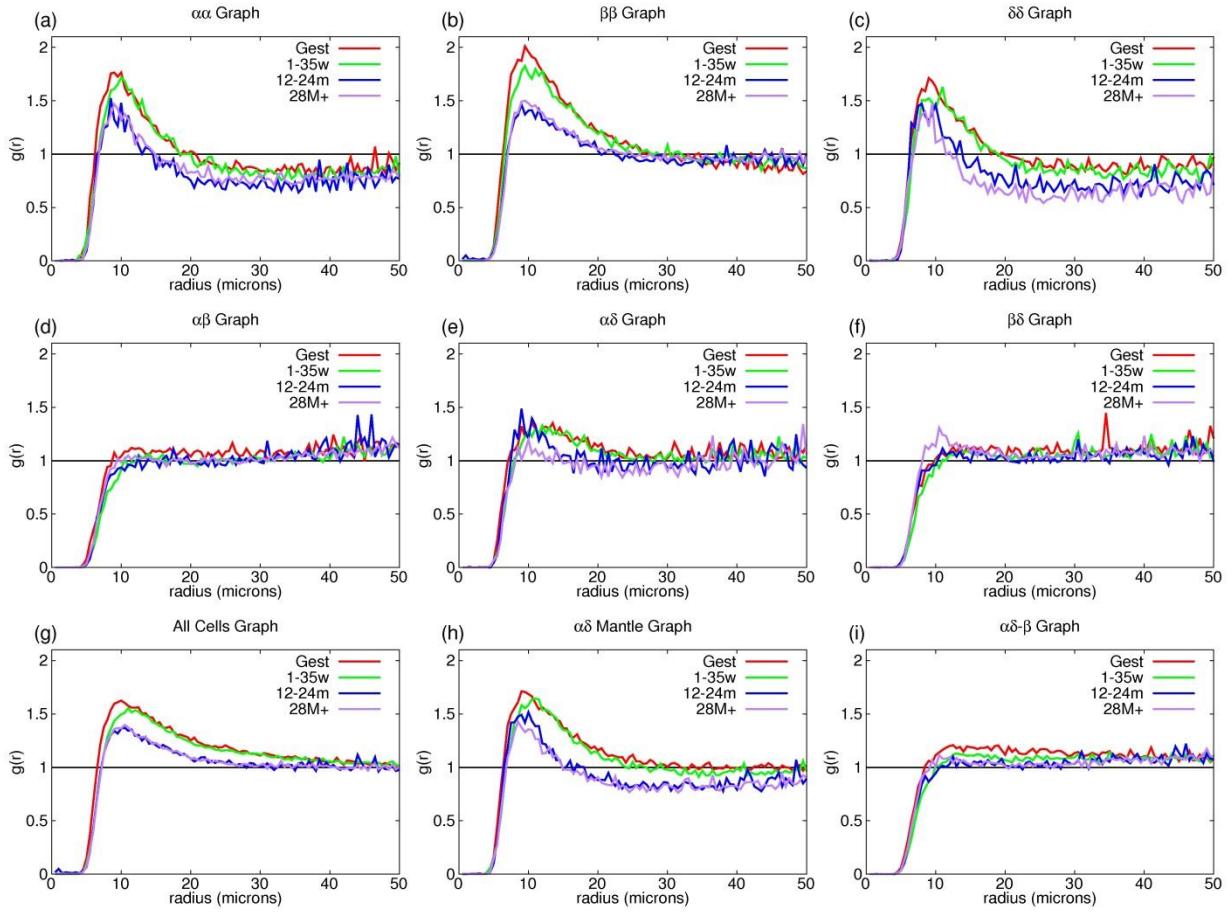


1 **Supplementary Figures**

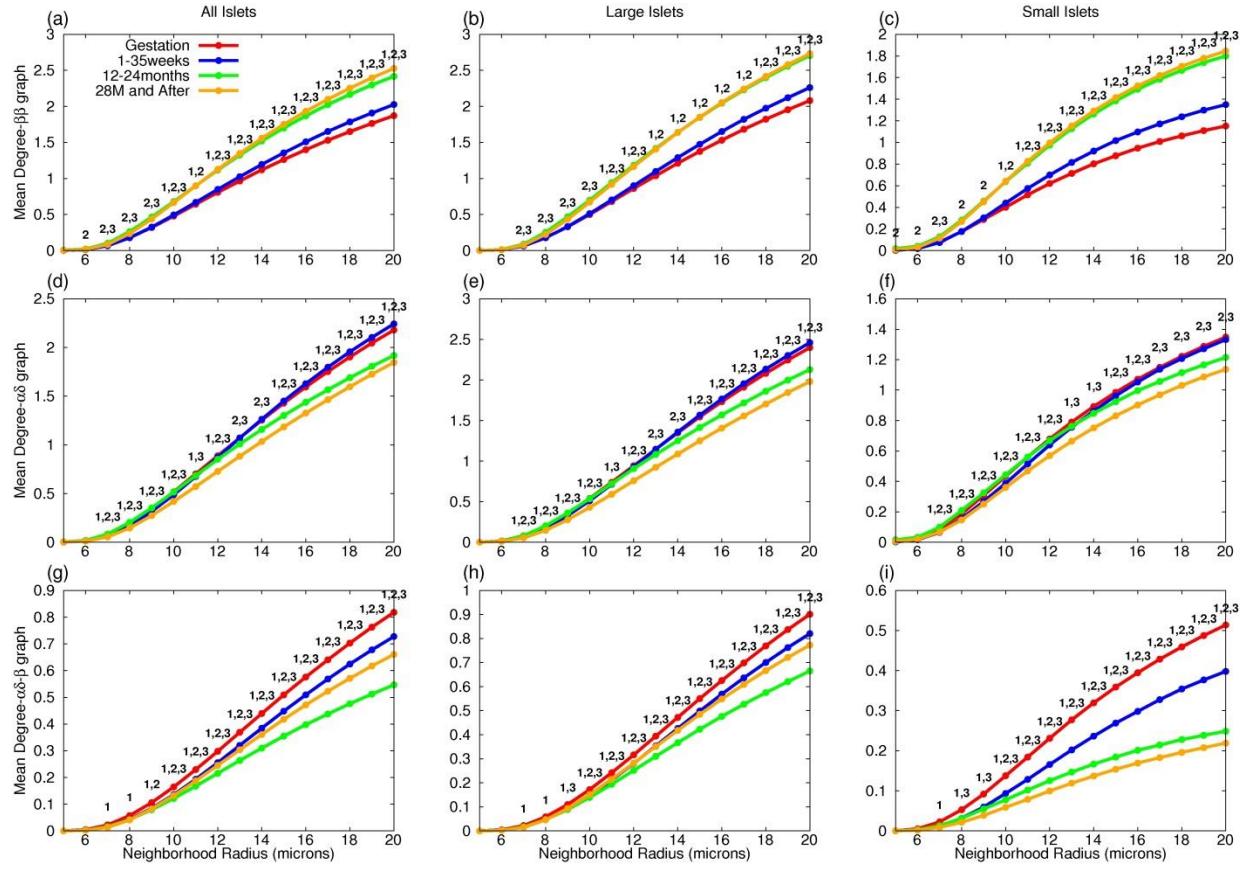


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3 **Figure S1.** A range of radii, for which more intercell distance pairs than expected if the vertices were
4 randomly distributed, are seen for $\alpha\alpha$ (a), $\beta\beta$ (b), $\delta\delta$ (c), and $\alpha\delta$ (e) graphs along with graphs representing
5 all interactions (g) and the $\alpha\delta$ graph (h).

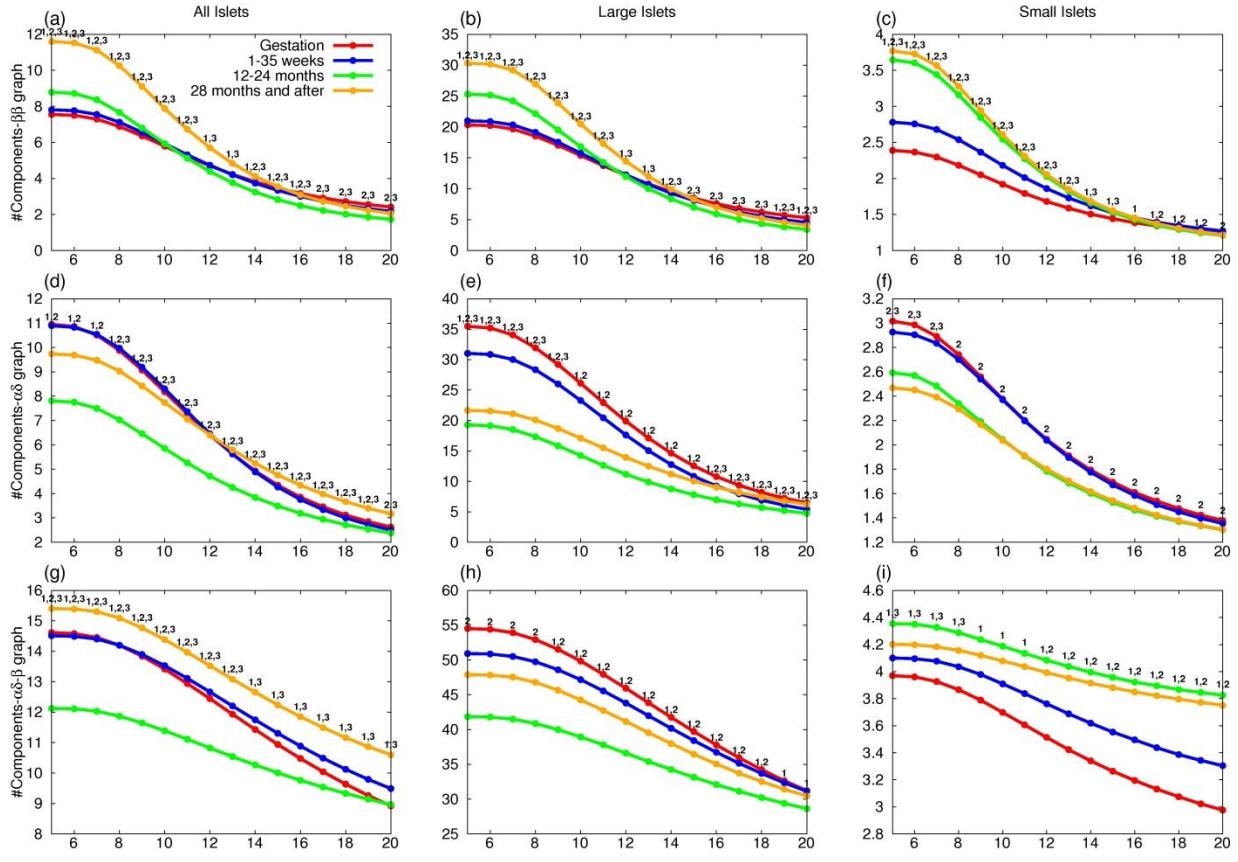
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Figure S2. Statistical significance of mean degree does not vary greatly for radii around 10. (a)-(i). The mean degree of the $\beta\beta$ graph (row 1), $\alpha\delta$ graph (row 2), and $\alpha\delta-\beta$ graph (row 3) for all (column 1), large (column 2) and small (column 3) islets for different neighborhood radii. ^{1,2,3} indicate statically significant difference using Mann Whitney test with a Bonferroni correction ($N = 48$) between ¹gestation and 1-35 weeks, ²1-35 weeks and 12-24 months , and ³12-24 months to 28 months+. The neighborhood radius values used are to show how measure differences between datasets evolve with increased radius and are not meant to reflect biological function at any particular radius.



1 **Figure S3.** Statistical significance of number of components per islet does not vary greatly for radii
2 around 10. (a)-(i).The number of components per islet for the $\beta\beta$ graph (row 1), $\alpha\delta$ graph (row 2), and $\alpha\delta\beta$
3 graph (row 3) for all (column 1), large (column 2) and small (column 3) islets for different
4 neighborhood radii. ^{1,2,3} indicate statically significant difference using Mann Whitney test with a
5 Bonferroni correction ($N = 48$) between ¹gestation and 1-35 weeks, ²1-35 weeks and 12-24 months , and
6 ³12-24 months to 28 months+.

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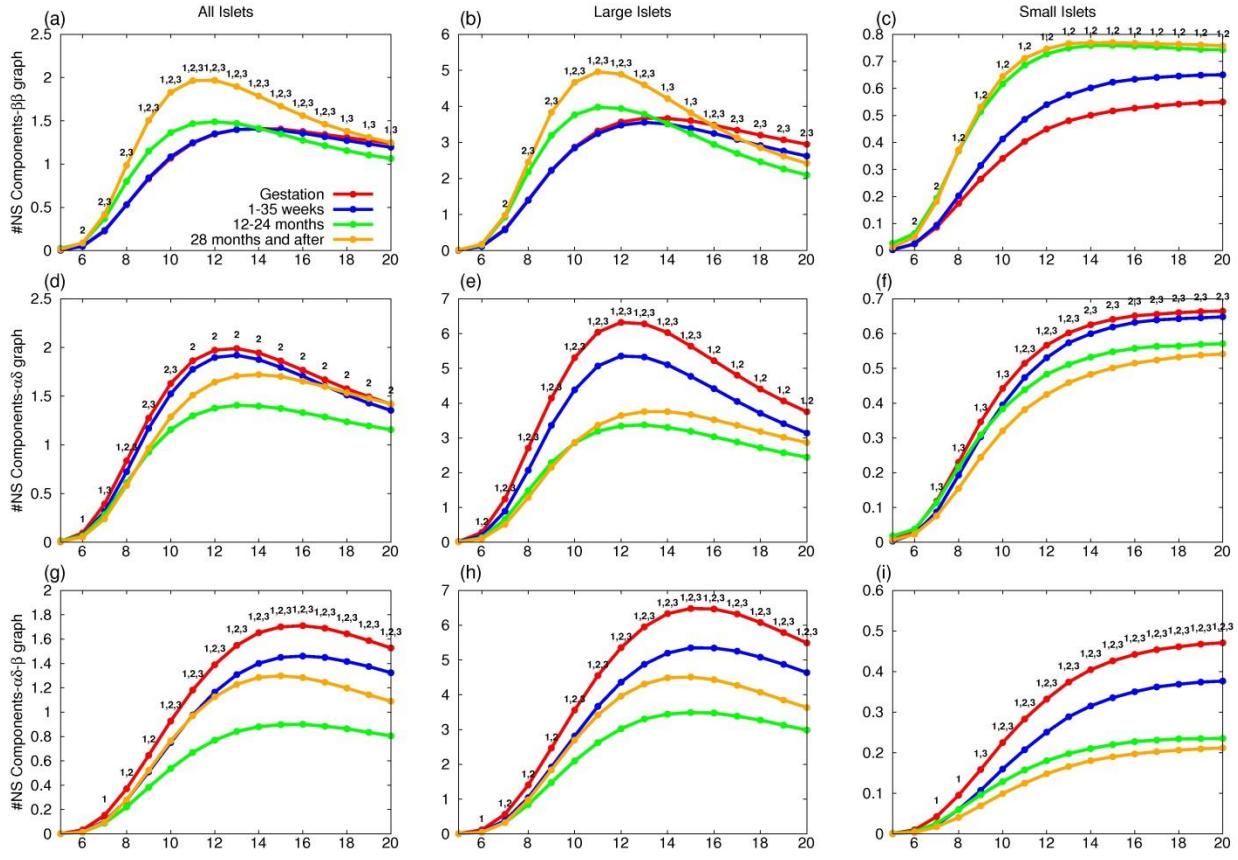


Figure S4. Statistical significance of number of nonsingular components per islet does not vary greatly for radii around 10. (a)-(i).The number of nonsingular components per islet for the $\beta\beta$ graph (row 1), $\alpha\delta$ graph (row 2), and $\alpha\delta-\beta$ graph (row 3) for all (column 1), large (column 2) and small (column 3) islets for different neighborhood radii. ^{1,2,3} indicate statically significant difference using Mann Whitney test with a Bonferroni correction ($N = 48$) between ¹gestation and 1-35 weeks, ²1-35 weeks and 12-24 months , and ³12-24 months to 28 months+.

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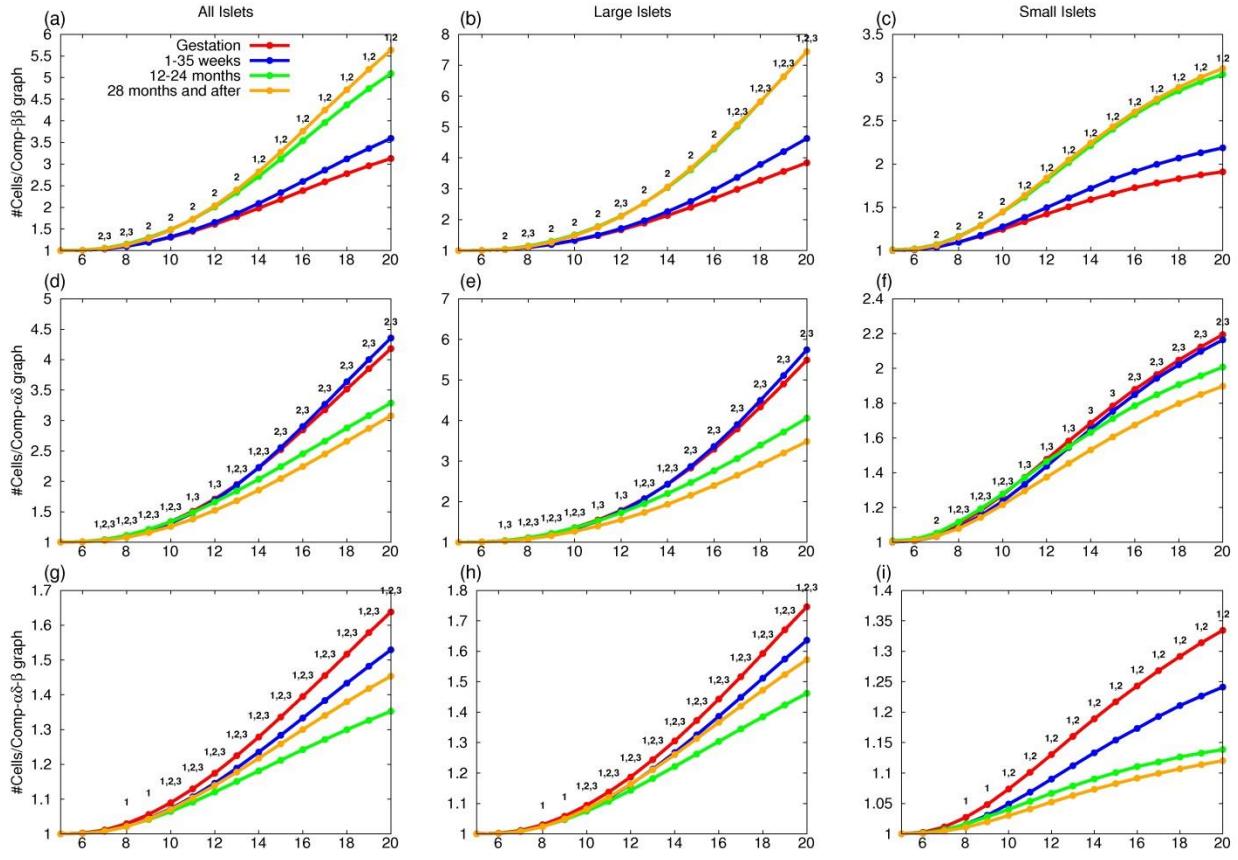
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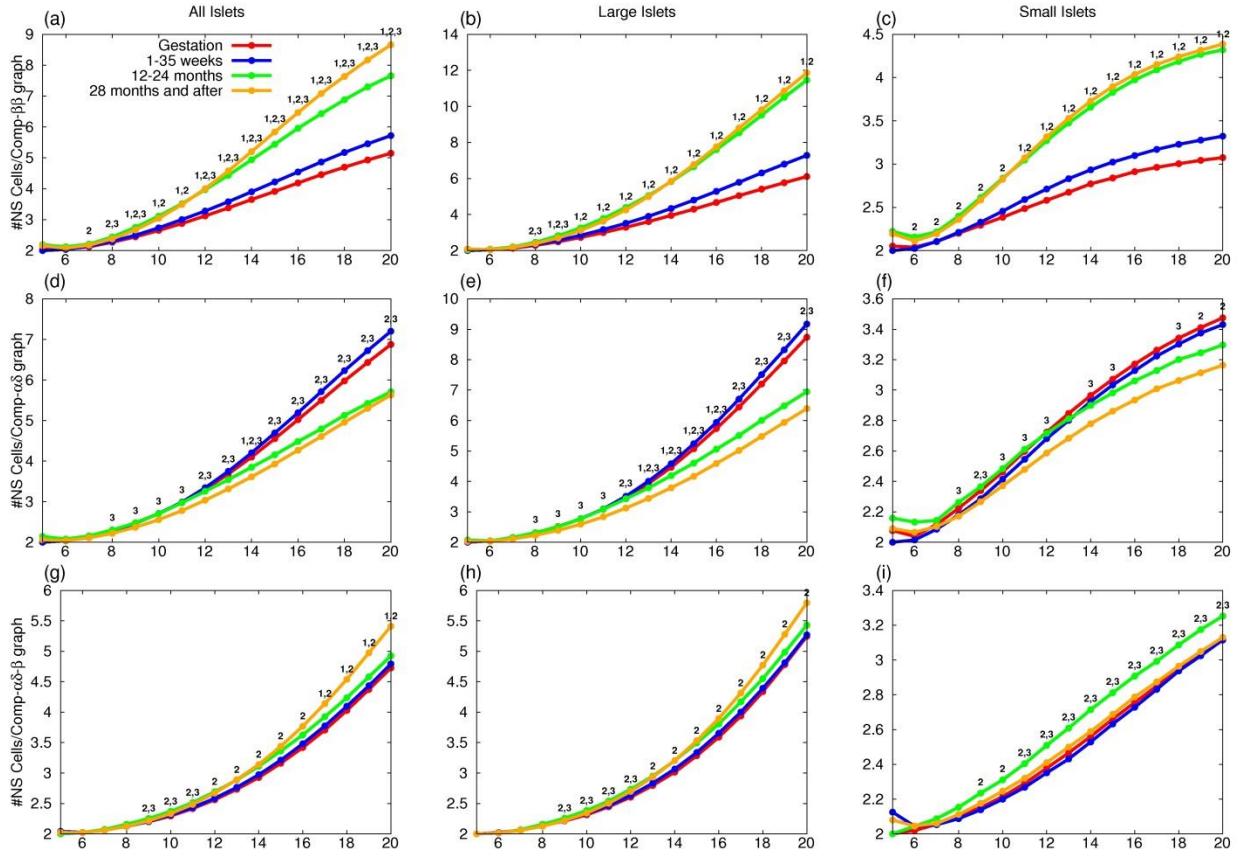
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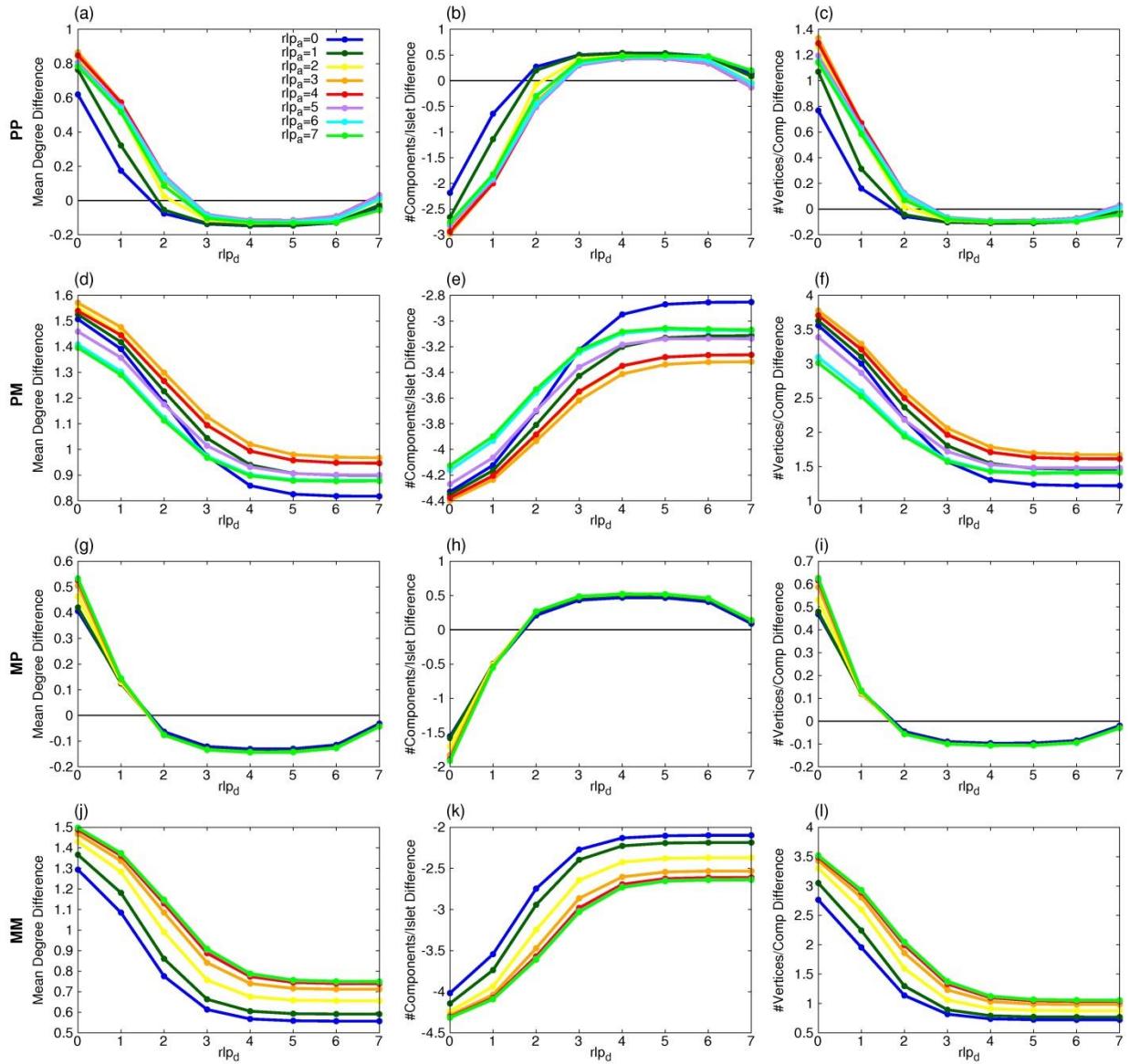
1 **Figure S5.** Statistical significance of number of cells per component does not vary greatly for radii
2 around 10. (a)-(i).The number of cells per components for the $\beta\beta$ graph (row 1), $\alpha\delta$ graph (row 2), and $\alpha\delta$ -
3 β graph (row 3) for all (column 1), large (column 2) and small (column 3) islets for different
4 neighborhood radii. ^{1,2,3} indicate statically significant difference using Mann Whitney test with a
5 Bonferroni correction ($N = 48$) between ¹gestation and 1-35 weeks, ²1-35 weeks and 12-24 months , and
6 ³12-24 months to 28 months+.

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2 **Figure S6.** Statistical significance of number of cells per nonsingular component does not vary greatly for
3 radii around 10. (a)-(i).The number of cells per nonsingular components for the $\beta\beta$ graph (row 1), $\alpha\delta$
4 graph (row 2), and $\alpha\delta-\beta$ graph (row 3) for all (column 1), large (column 2) and small (column 3) islets for
5 different neighborhood radii. ^{1,2,3} indicate statically significant difference using Mann Whitney test with a
6 Bonferroni correction ($N = 48$) between ¹gestation and 1-35 weeks, ²1-35 weeks and 12-24 months , and
7 ³12-24 months to 28 months+.

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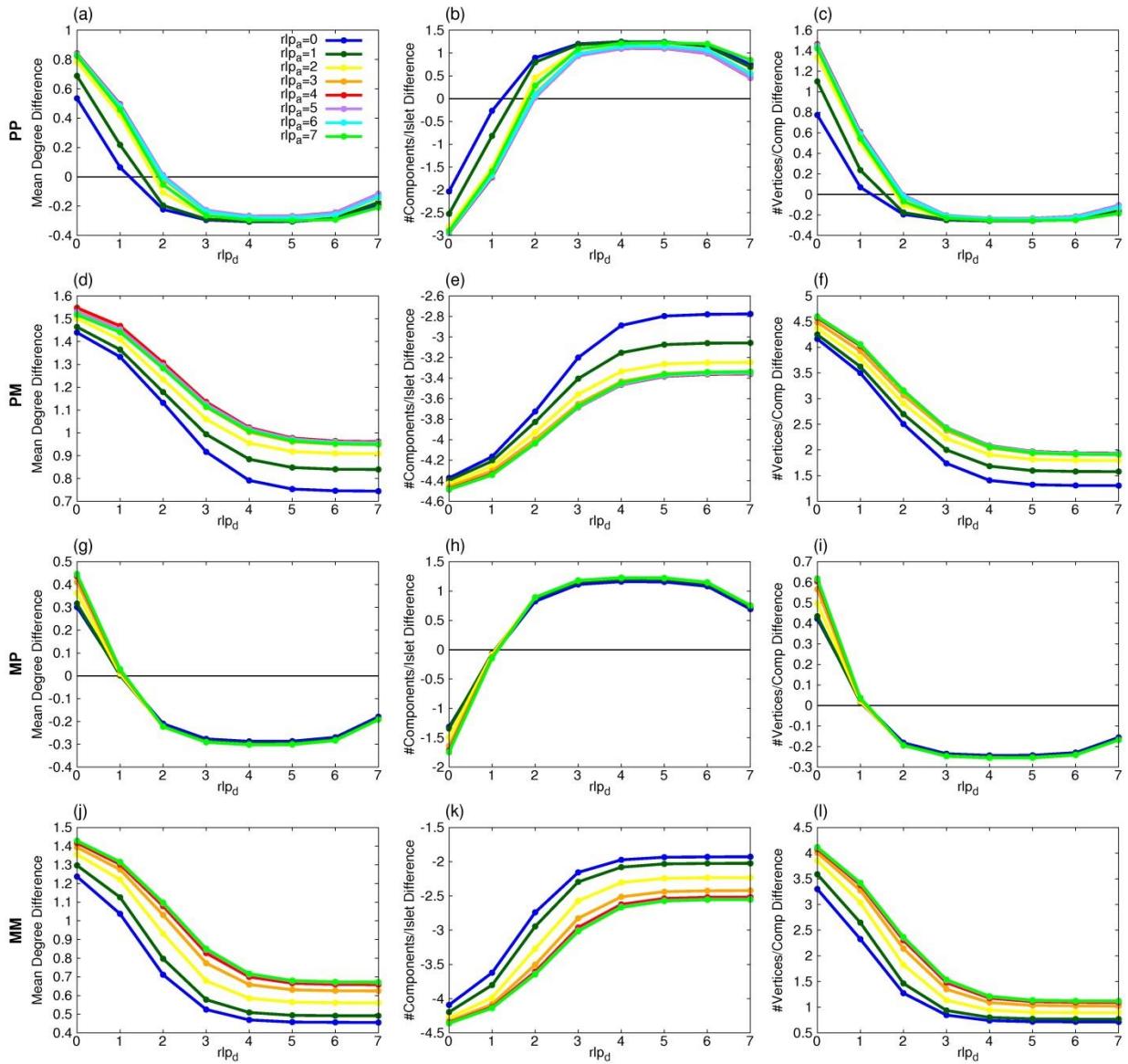


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2 **Figure S7.** Transition 1 (gestation to 1-35 weeks) $\beta\beta$ graph simulation measure differences. The
3 difference in mean degree (column 1), number of components per islet graph (column 2) and number of
4 vertices per component (column 3) between the resulting $\beta\beta$ graph simulation and that of the next
5 developmental stage, 1-35 weeks, for each process, (PP (row 1), PM (row 2), MP (row 3) and MM (row
6 4)). Each point represents a given (rlp_a, rlp_d) pair. Measure equilibria are found for each developmental
7 transition for the PP and MP processes.

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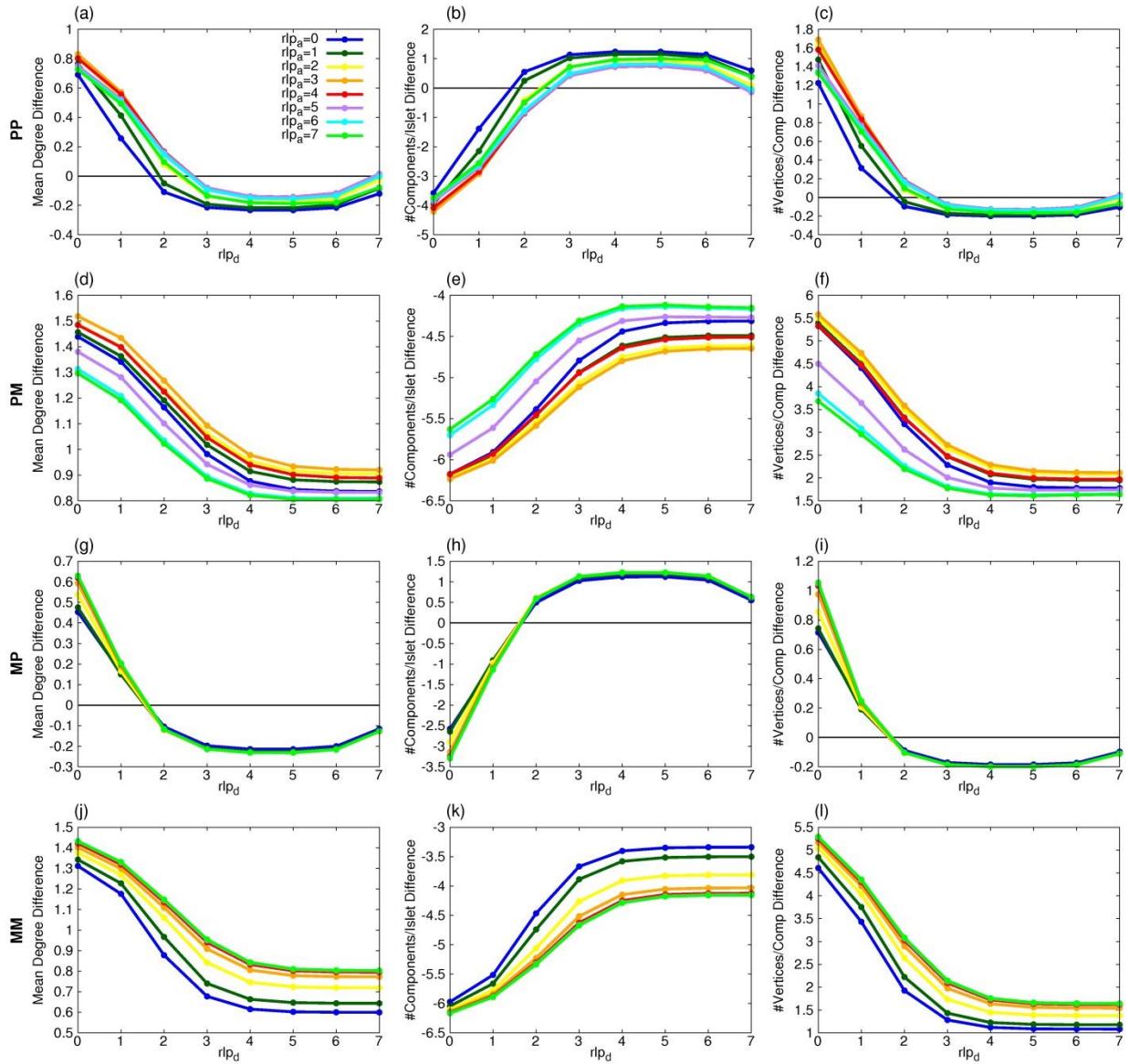


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2 **Figure S8.** Transition 2 (1-35 weeks to 12-24 months) $\beta\beta$ graph simulation measure differences. The
3 difference in mean degree (column 1), number of components per islet graph (column 2) and number of
4 vertices per component (column 3) between the resulting $\beta\beta$ graph simulation and that of the next
5 developmental stage, 12-24 months, for each process, (PP (row 1), PM (row 2), MP (row 3) and MM
6 (row 4)) Each point represents a given (rlp_a, rlp_d) pair. Measure equilibria are found for each
7 developmental transition for the PP and MP processes.

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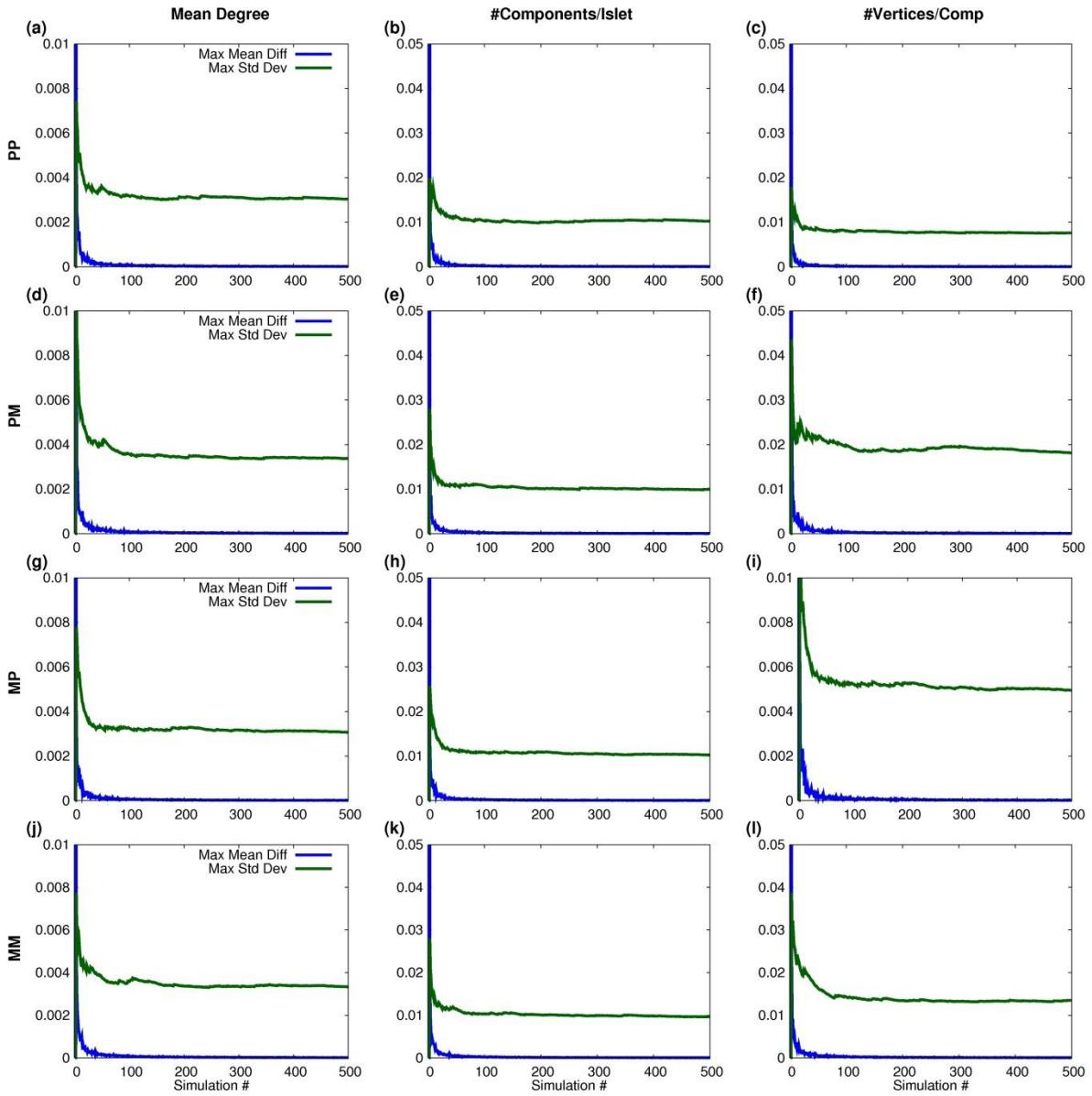
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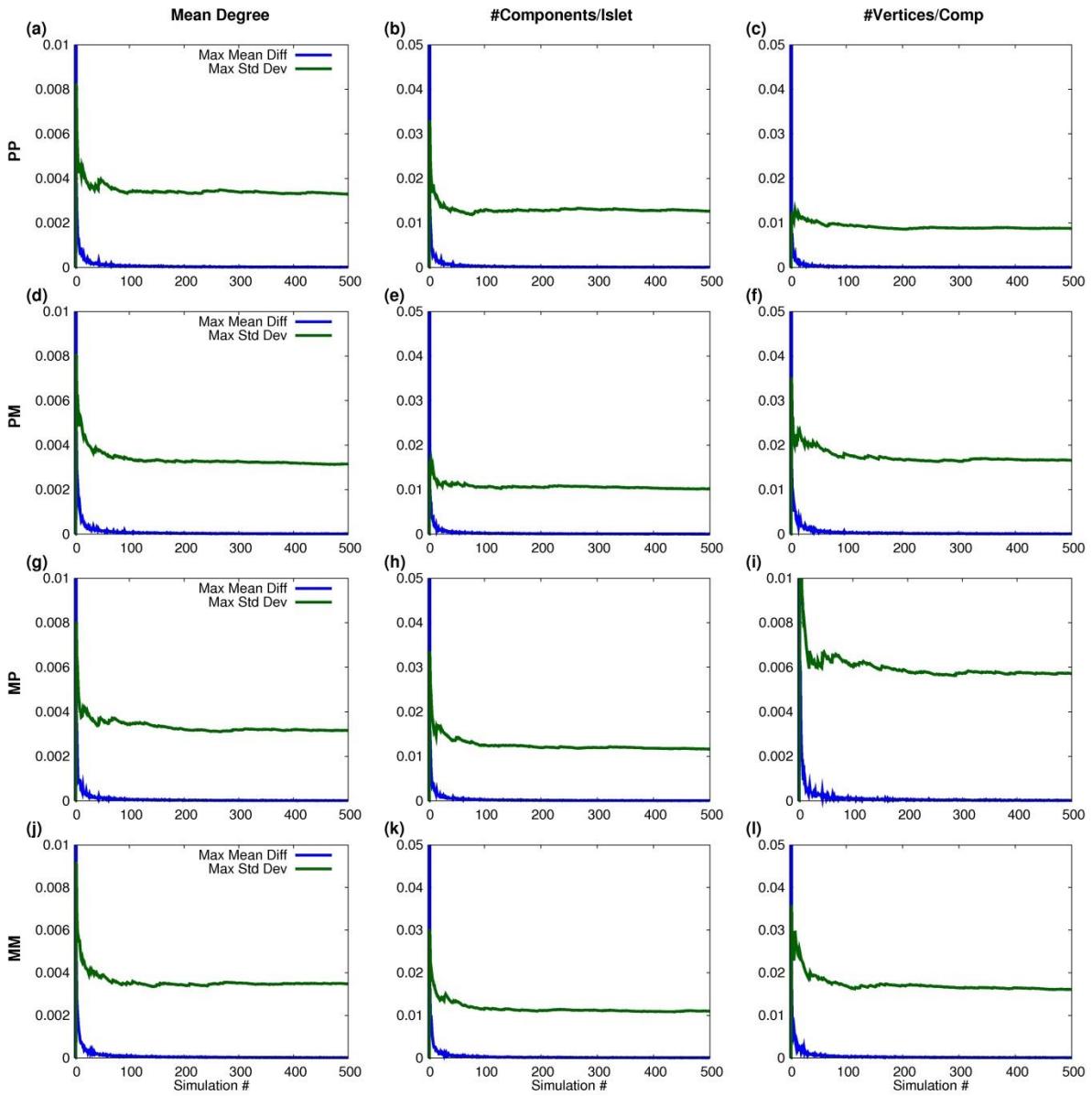
2 **Figure S9.** Transition 3 (12-24 months to 28 months+) $\beta\beta$ graph simulation measure differences. The
3 difference in mean degree (column 1), number of components per islet graph (column 2) and number of
4 vertices per component (column 3) between the resulting $\beta\beta$ graph simulation and that of the next
5 developmental stage, 28 months+, for each process, (PP (row 1), PM (row 2), MP (row 3) and MM (row
6 4)). Each point represents a given (rlp_a, rlp_d) pair. Measure equilibria are found for each developmental
7 transition for the PP and MP processes.

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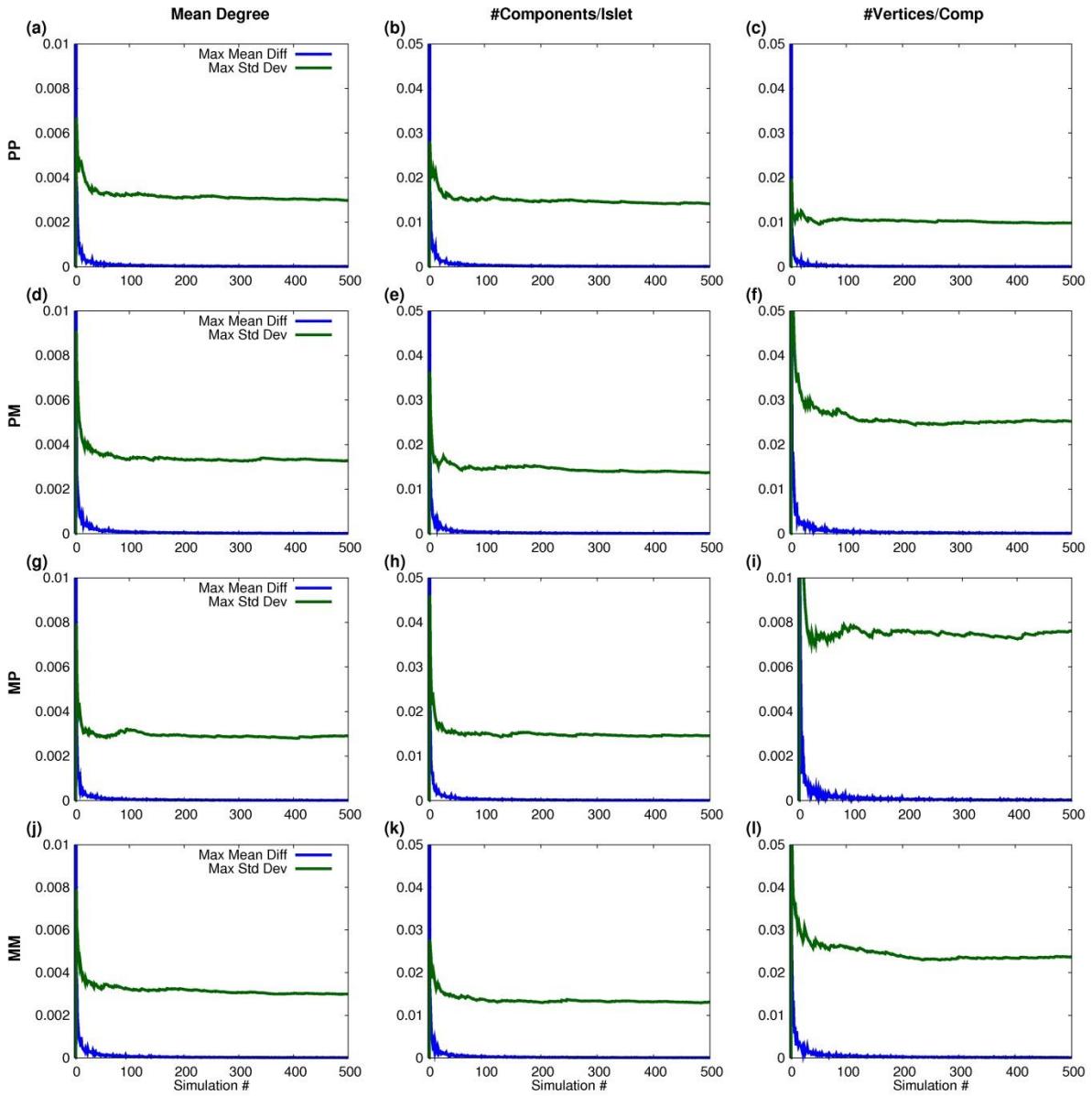
2 **Figure S10.** Transition 1 (gestation to 1-35 weeks) simulation convergence. The maximal change of
3 mean degree and standard deviation per (rlp_a, rlp_d) pair is plotted with respect to the addition of each
4 simulation. Each subgraph corresponds to the results given in figure S7.



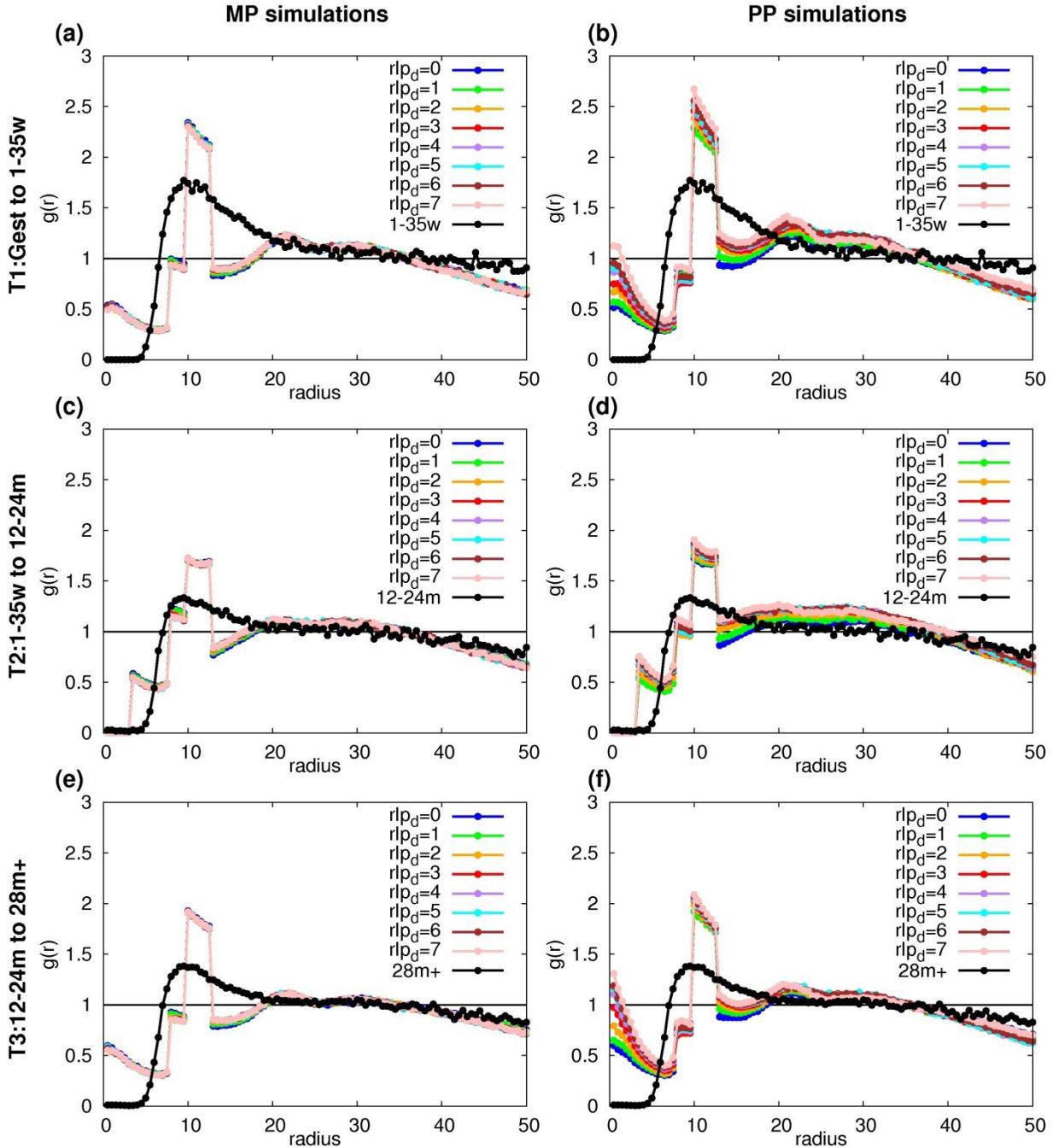
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2 **Figure S11.** Transition 2 (1-35 weeks to 12-24 months) simulation convergence. The maximal change of
 3 mean degree and standard deviation per (rlp_a, rlp_d) pair is plotted with respect to the addition of each
 4 simulation. Each subgraph corresponds to the results given in figure S8.

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2 **Figure S12.** Transition 3 (12-24 months to 28 months+) simulation convergence. The maximal change of
3 mean degree and standard deviation per (rlp_a, rlp_d) pair is plotted with respect to the addition of each
4 simulation. Each subgraph corresponds to the results given in figure S9.



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2 **Figure S13.** Pair correlation functions of the measure-equilibrium simulations for each transition. Ten
3 simulations were run for each (rlp_a, rlp_d) producing measure equilibria (values are given in Table S10).
4 The average pair correlation function was found for islets containing more than 5 cells and compared to
5 the islets containing more than 5 cells in the next developmental stage. The integration of the absolute
6 value of the difference between the pair correlation function of the given dataset and that of each measure
7 equilibrium is given in Table S10.
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1 Supplementary Tables

2 **Table S1.** The mean and standard deviation of the vertex degree of the $\beta\beta$ graph (corresponding to figure
3 5(a)). The number of vertices having a given degree is also given per dataset and islet size.

Islet Size	Dataset	Mean	Std Dev	Degree Count					
				0	1	2	3	4	5
all	Gestation	0.477	0.695	124,555	56,798	15,404	2,290	144	6
all	1-35 weeks	0.493	0.714	109,443	49,705	14,742	2,410	156	7
all	12-24 months	0.679	0.831	97,984	60,383	24,511	5,526	559	19
all	28 months+	0.665	0.813	262,968	163,766	63,699	13,138	1,192	34
large	Gestation	0.500	0.7151	94,888	44,045	13,132	2,066	137	5
large	1-35 weeks	0.512	0.7361	80,514	36,202	12,032	2,078	137	6
large	12-24 months	0.699	0.853	66,433	40,009	17,675	4,274	440	17
large	28 months+	0.672	0.823	202,736	123,835	50,511	10,793	973	26
small	Gestation	0.401	0.611	29,665	12,755	2,272	224	7	1
small	1-35 weeks	0.440	0.644	28,929	13,503	2,711	330	20	1
small	12-24 months	0.637	0.780	31,551	20,373	6,838	1,251	119	2
small	28 months+	0.641	0.777	60,231	39,935	13,185	2,345	219	8

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Table S2. The mean and standard deviation of the number of components per islet of the $\beta\beta$ graph (corresponding to figure 5(b)). The number of islets having a given number of components is also shown per dataset and islet size. Values for nonsingular islets are given in parentheses.

Table S3. The mean and standard deviation of the number of cells per component of the $\beta\beta$ graph (corresponding to figure 5(c)). The number of components having a given number of cells is also shown per dataset and islet size. Values for nonsingular islets are given in parentheses.

Islet Size	Data	Mean	Std Dev	# Cells-per-Component Count							
				1	2	3	4	5	6	7	8
all	Gest	1.304 (2.651)	0.863 (1.348)	124555	18521	5619	2079	922	430	233	125
all	1-35w	1.318 (2.737)	0.909 (1.434)	109443	15504	4957	1979	940	464	261	135
all	12-24m	1.486 (3.113)	1.390 (2.229)	97984	16560	6003	2757	1354	841	510	325
all	28m+	1.474 (3.042)	1.268 (1.929)	262968	45113	16459	7522	4086	2221	1323	891
large	Gest	1.323 (2.729)	0.923 (1.460)	94888	13766	4489	1749	822	379	217	115
large	1-35w	1.333 (2.843)	0.974 (1.573)	80514	10688	3698	1579	781	396	235	127
large	12-24m	1.505 (3.259)	1.510 (2.495)	66433	10470	3861	1881	971	616	382	249
large	28m+	1.481 (3.113)	1.317 (2.040)	202736	33225	12249	5806	3228	1819	1087	744
small	Gest	1.246 (2.385)	0.630 (0.812)	29665	4756	1130	330	100	51	16	10
small	1-35w	1.275 (2.455)	0.696 (0.919)	28929	4817	1260	400	158	68	26	8
small	12-24m	1.445 (2.837)	1.102 (1.567)	31551	6090	2142	876	383	225	128	76
small	28m+	1.450 (2.824)	1.091 (1.523)	60231	11889	4210	1719	857	402	235	147

1 **Table S4.** The mean and standard deviation of the vertex degree of the $\alpha\delta$ graph (corresponding to figure
 2 6(a)). The number of vertices having a given degree is also given per dataset and islet size.

Islet Size	Dataset	Mean	Std Dev	Degree Count					
				0	1	2	3	4	5
all	Gestation	0.518	0.716	215298	108701	31238	4777	282	6
all	1-35 weeks	0.487	0.705	153467	69999	20183	3040	187	11
all	12-24 months	0.515	0.719	68612	34222	9633	1621	124	1
all	28 months+	0.419	0.651	199833	80325	19040	2425	156	4
large	Gestation	0.540	0.733	167255	86704	26669	4314	262	6
large	1-35 weeks	0.511	0.724	121410	57192	17767	2790	175	10
large	12-24 months	0.537	0.736	51939	26524	8008	1415	107	1
large	28 months+	0.430	0.662	166809	67991	16973	2219	140	4
small	Gestation	0.434	0.639	48039	22001	4565	467	20	0
small	1-35 weeks	0.388	0.612	32061	12803	2416	250	12	1
small	12-24 months	0.444	0.652	16673	7698	1625	206	17	0
small	28 months+	0.360	0.589	33022	12332	2071	206	16	0

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Table S5. The mean and standard deviation of the number of components per islet of the δ graph (corresponding to figure 6(b)). The number of islets having a given number of components is also shown per dataset and islet size. Values for nonsingular islets are given in parentheses.

Table S6. The mean and standard deviation of the number of cells per component of the $\alpha\delta$ graph (corresponding to figure 6(c)). The number of components having a given number of cells is also shown per dataset and islet size. Values for nonsingular islets are given in parentheses.

Islet Size	Dataset	Mean	Std Dev	# Cells per-Component Count							
				1	2	3	4	5	6	7	8
all	Gest	1.340 (2.705)	0.945 (1.466)	215298	34648	10606	4238	1840	947	521	281
all	1-35w	1.313 (2.706)	0.906 (1.448)	153467	22282	6885	2714	1213	583	316	175
all	12-24m	1.336 (2.701)	0.949 (1.497)	68612	11022	3278	1272	578	319	160	95
all	28m+	1.259 (2.557)	0.749 (1.163)	199833	27525	7507	2590	1108	514	253	153
large	Gest	1.359 (2.768)	1.001 (1.564)	167255	26752	8640	3564	1588	848	462	260
large	1-35w	1.333 (2.772)	0.961 (1.536)	121410	17564	5736	2376	1093	537	302	162
large	12-24m	1.354 (2.765)	1.009 (1.606)	51939	8292	2561	1048	486	278	142	81
large	28m+	1.267 (2.591)	0.774 (1.208)	166809	22875	6423	2321	1013	479	239	142
small	Gest	1.272 (2.462)	0.706 (0.969)	48039	7898	1964	674	252	98	57	22
small	1-35w	1.236 (2.415)	0.647 (0.919)	32061	4716	1149	338	120	46	14	13
small	12-24m	1.278 (2.483)	0.728 (1.019)	16673	2730	717	224	92	41	18	14
small	28m+	1.216 (2.371)	0.604 (0.855)	33022	4650	1084	268	95	36	14	11

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2 **Table S7.** The mean and standard deviation of the vertex degree of the $\alpha\delta\beta$ graph (corresponding to
 3 figure 6(d)). The number of vertices having a given degree is also given per dataset and islet size.

Islet Size	Dataset	Mean	StdDev	Degree Count					
				0	1	2	3	4	5
all	Gestation	0.164	0.422	478057	71705	8939	763	35	0
all	1-35 weeks	0.136	0.391	372793	44245	5772	516	23	1
all	12-24 months	0.122	0.379	271359	27320	4041	439	35	1
all	28 months+	0.132	0.389	713154	81162	11150	1056	56	2
large	Gestation	0.172	0.433	373083	58059	7612	697	32	0
large	1-35 weeks	0.148	0.408	287730	36962	5117	483	20	1
large	12-24 months	0.139	0.404	190907	22147	3385	372	30	1
large	28 months+	0.151	0.413	558251	73380	10334	992	51	2
small	Gestation	0.138	0.380	104970	13652	1325	66	3	0
small	1-35 weeks	0.094	0.318	85063	7283	655	33	3	0
small	12-24 months	0.078	0.304	80452	5173	656	67	5	0
small	28 months+	0.059	0.261	154905	7779	816	65	5	0

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Table S8. The mean and standard deviation of the number of components per islet of the $\alpha\delta$ - β graph (corresponding to figure 6(e)). The number of islets having a given number of components is also shown per dataset and islet size. Values for nonsingular islets are given in parentheses.

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Table S9. The mean and standard deviation of the number of cells per component of the $\alpha\delta\beta$ graph (corresponding to figure 6(f)). The number of components having a given number of cells is also shown per dataset and islet size. Values for nonsingular islets are given in parentheses.

Islet Size	Dataset	Mean	Std Dev	# Cells-per-Component Count							
				1	2	3	4	5	6	7	8
all	Gest	1.089 (2.295)	0.371 (0.658)	478057	27743	5843	1341	370	131	32	16
all	1-35w	1.073 (2.312)	0.341 (0.686)	372793	16910	3670	920	241	79	24	12
all	12-24m	1.065 (2.370)	0.337 (0.783)	271359	9908	2602	618	189	68	20	12
all	28m+	1.071 (2.333)	0.341 (0.711)	713154	30485	7014	1778	502	162	68	21
large	Gest	1.094 (2.314)	0.385 (0.684)	373083	22129	4877	1179	335	118	31	15
large	1-35w	1.080 (2.334)	0.361 (0.713)	287730	13866	3198	831	231	73	20	12
large	12-24m	1.075 (2.384)	0.364 (0.805)	190907	7935	2169	511	163	56	19	11
large	28m+	1.082 (2.342)	0.367 (0.723)	558251	27362	6425	1668	480	153	62	20
small	Gest	1.074 (2.214)	0.318 (0.526)	104970	5618	966	161	35	13	1	1
small	1-35w	1.049 (2.200)	0.260 (0.517)	85063	3044	472	89	10	6	4	0
small	12-24m	1.040 (2.310)	0.256 (0.681)	80452	1973	433	107	26	12	1	1
small	28m+	1.030 (2.246)	0.213 (0.587)	154905	3120	589	111	22	9	6	1

1 **Table S10.** For each simulation type and rlp_a value, the rlp_d value that produced measure equilibrium was
 2 found. Simulations for each set were run and their pair correlation functions are given in Figure S13.
 3 The integration of the absolute value of the difference between the pair correlation function of the given
 4 developmental stage dataset and that of each measure equilibrium is given (Diff).

Gestation to 1-35 weeks			1-35 weeks to 12-24 months			12-24 months to 28 months+					
Sim Type	rlp_a	rlp_d	Diff	Sim Type	rlp_a	rlp_d	Diff	Sim Type	rlp_a	rlp_d	Diff
MP	0	1.6776	12.26	MP	0	1.0483	6.40	MP	0	1.6028	8.59
MP	1	1.6312	12.08	MP	1	1.0079	6.32	MP	1	1.5573	8.40
MP	2	1.6278	12.02	MP	2	1.04	6.43	MP	2	1.5774	8.46
MP	3	1.6442	12.12	MP	3	1.0872	6.48	MP	3	1.6119	8.49
MP	4	1.6528	12.12	MP	4	1.1094	6.51	MP	4	1.6291	8.52
MP	5	1.6547	12.13	MP	5	1.1148	6.60	MP	5	1.6333	8.55
MP	6	1.6553	12.09	MP	6	1.1152	6.58	MP	6	1.6345	8.56
MP	7	1.6552	12.11	MP	7	1.1154	6.59	MP	7	1.6345	8.55
PP	0	1.696	12.13	PP	0	1.2242	6.70	PP	0	1.7038	8.67
PP	1	1.8544	12.51	PP	1	1.5272	7.17	PP	1	1.8927	9.22
PP	2	2.1751	13.29	PP	2	1.7954	7.91	PP	2	2.3573	9.93
PP	3	2.5684	13.66	PP	3	1.9726	8.57	PP	3	2.6218	10.51
PP	4	2.6459	14.01	PP	4	2.0528	8.78	PP	4	2.6779	10.77
PP	5	2.645	14.17	PP	5	2.0534	8.80	PP	5	2.6698	10.96
PP	6	2.5929	13.99	PP	6	1.9963	8.74	PP	6	2.6126	10.76
PP	7	2.4546	13.86	PP	7	1.8958	8.42	PP	7	2.4185	10.32