

Table S1

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Table S2. General linear mixed model of effects of the maternal and F1 own social environment on female body mass.

Fixed effects							
	Estimate	SE	df	t	χ^2	df	p
(Intercept)	205.200	4.620	35.870	44.403			
Day * maternal social environment * own social environment ^a	0.002	0.254	286.900	0.006			
Day ² * maternal social environment * own social environment ^a	0.022	0.013	286.900	1.667	4.51	3	0.21
Day ³ * maternal social environment * own social environment ^a	-4.62*10 ⁻⁴	3.13*10 ⁻⁴	287.100	-1.474			
Day * maternal social environment ^a	0.030	0.126	286.900	0.236			
Day ² * maternal social environment ^a	0.003	0.007	286.900	0.459	0.46	3	0.93
Day ³ * maternal social environment ^a	-5.64*10 ⁻⁵	-1.54*10 ⁻⁴	286.900	-0.366			
Day * own social environment	0.168	0.128	287.000	1.313			
Day² * own social environment	-0.002	0.007	286.900	-0.225	21.94	3	< 0.001
Day³ * own social environment	7.25*10⁻⁵	1.57*10⁻⁴	287.100	0.460			
Maternal social environment * own social environment	-13.260	6.391	34.090	-2.076	4.14	1	0.04
Day	2.215	0.082	286.900	26.884			< 0.001
Day ²	-0.086	0.004	286.700	-19.739			< 0.001
Day ³	-8.97*10 ⁻⁴	9.93*10 ⁻⁵	286.800	9.038			< 0.001
Maternal social environment	3.648	6.506	34.100	0.561			0.58
Own social environment	14.370	4.723	42.220	3.043			0.004
Random effects							
	Variance	Std.Dev.					
Maternal ID : F1 ID^b	85.45	9.244					
Maternal ID	159.47	12.628					
Residual	120.24	10.966					
Post-hoc tests; split by maternal social environment:							
Offspring of pair-housed mothers							
Fixed effects							
	Estimate	SE	df	t	χ^2	df	p
(Intercept)	205.800	5.636	15.520	36.513			
Day * own social environment	0.165	0.169	146.600	0.975			
Day ² * own social environment	-0.013	0.009	146.400	-1.466	20.77	3	< 0.001
Day ³ * own social environment	3.08*10 ⁻⁴	2.08*10 ⁻⁴	146.700	1.482			

Day	2.194	0.103	146.600	21.265				<0.001
Day ²	-0.083	0.005	146.300	-15.353				<0.001
Day ³	8.42*10 ⁻⁴	1.24*10 ⁻⁴	146.400	6.814				<0.001
Own social environment	15.530	3.685	31.050	4.214				<0.001
Random effects								
	Variance	Std.Dev.						
Maternal ID : F1 ID^b	28.370	5.327						
Maternal ID	342.450	18.506						
Residual	102.540	10.126						
Offspring of group-housed mothers								
Fixed effects								
	Estimate	SE	df	t	χ ²	df	p	
(Intercept)	208.800	4.209	32.390	49.601				
Day * own social environment	0.164	0.191	140.400	0.858				
Day ² * own social environment	0.009	0.010	140.400	0.925	6.55	3	0.09	
Day ³ * own social environment	1.48*10 ⁻⁴	2.35*10 ⁻⁴	140.400	-0.632				
Day	2.241	0.129	140.300	17.373				<0.001
Day ²	-0.090	0.007	140.300	-13.013				<0.001
Day ³	9.66*10 ⁻⁴	1.57*10 ⁻⁴	140.300	6.172				<0.001
Own social environment	-1.544	5.494	34.330	-0.281				0.78
Random effects								
	Variance	Std.Dev.						
Maternal ID : F1 ID^b	122.610	11.073						
Maternal ID	37.150	6.095						
Residual	134.390	11.593						
Post-hoc tests; split by own social environment								
Pair-housed F1 females								
Fixed effects								
	Estimate	SE	df	t	χ ²	df	p	
(Intercept)	202.400	4.154	19.270	48.727				
Day	2.215	0.077	168.700	28.641				
Day ²	-0.086	0.004	168.700	-21.038	476.62	3	< 0.001	
Day ³	8.98*10 ⁻⁴	9.31*10 ⁻⁵	168.700	9.640				
Maternal social environment	5.322	5.883	17.940	0.905	0.81	1	0.37	
Random effects								
	Variance	Std.Dev.						
Maternal ID : F1 ID^b	85.190	9.230						
Maternal ID	101.430	10.070						
Residual	105.850	10.290						
Group-housed F1 females								
Fixed effects								
	Estimate	SE	df	t	χ ²	df	p	
(Intercept)	218.000	6.102	19.490	35.731				

Day	2.383	0.106	117.600	22.496				
Day ²	-0.088	0.006	117.600	-15.855	331.68	3	< 0.001	
Day ³	9.68*10 ⁻⁴	1.32*10 ⁻⁴	117.700	7.315				
Maternal social environment	-11.430	8.379	17.280	-1.364	1.77	1	0.18	
Random effects								
	Variance	Std.Dev.						
Maternal ID : F1 ID ^b	63.110	7.944						
Maternal ID	244.420	15.634						
Residual	141.150	11.881						
Post-hoc tests; split by day								
Day 24								
Fixed effects								
	Estimate	SE	df	t	χ ²	df	p	
(Intercept)	116.295	3.561	28.387	32.662				
Maternal social environment	-2.113	4.779	23.580	-0.442	0.2	1	0.66	
Own social environment	3.441	2.893	34.772	1.189	1.39	1	0.24	
Maternal social environment * own social environment ^a	-2.135	5.811	34.585	-0.367	0.13	1	0.72	
Random effects								
	Variance	Std.Dev.						
Maternal ID	95.840	9.790						
Residual	88.530	9.409						
Day 30								
Fixed effects								
	Estimate	SE	df	t	χ ²	df	p	
(Intercept)	149.121	4.292	27.343	34.741				
Maternal social environment	-5.379	5.861	23.980	-0.918	0.83	1	0.36	
Own social environment	4.349	2.894	31.810	1.503	2.19	1	0.14	
Maternal social environment * own social environment ^a	-8.599	5.729	31.905	-1.501	2.19	1	0.14	
Random effects								
	Variance	Std.Dev.						
Maternal ID	171.760	13.106						
Residual	83.810	9.155						
Day 37								
Fixed effects								
	Estimate	SE	df	t	χ ²	df	p	
(Intercept)	180.357	4.879	33.334	36.968				
Maternal social environment	3.955	7.085	35.612	0.558			0.58	
Own social environment	13.919	5.018	33.335	2.774			0.009	
Maternal social environment * own social environment	-16.558	7.219	34.714	-2.294	5.00	1	0.03	
Random effects								

	Variance	Std.Dev.					
Maternal ID	177.000	13.300					
Residual	135.300	11.630					
Day 44							
Fixed effects							
	Estimate	SE	df	t	χ^2	df	p
(Intercept)	208.473	5.542	32.531	37.617			
Maternal social environment	6.778	8.053	34.895	0.842			0.41
Own social environment	19.030	5.775	32.545	3.295			0.002
Maternal social environment * own social environment	-16.671	8.306	33.983	-2.007	3.88	1	0.049
Random effects							
	Variance	Std.Dev.					
Maternal ID	223.700	14.960					
Residual	179.900	13.410					
Day 61							
Fixed effects							
	Estimate	SE	df	t	χ^2	df	p
(Intercept)	220.301	5.640	28.335	39.064			
Maternal social environment	-2.699	7.355	21.428	-0.367	0.13	1	0.71
Own social environment	10.442	5.143	36.334	2.030	3.97	1	0.046
Maternal social environment * own social environment^a	-18.76	9.835	36.251	-1.907	3.49	1	0.06
Random effects							
	Variance	Std.Dev.					
Maternal ID	187.900	13.710					
Residual	280.700	16.750					
Day 90							
Fixed effects							
	Estimate	SE	df	t	χ^2	df	p
(Intercept)	214.755	4.930	24.713	43.559			
Maternal social environment	3.520	6.680	19.953	0.527	0.28	1	0.60
Own social environment	16.726	6.318	32.297	2.648	6.44	1	0.011
Maternal social environment * own social environment^a	-7.336	12.550	32.250	-0.585	0.34	1	0.56
Random effects							
	Variance	Std.Dev.					
Maternal ID	56.580	7.522					
Residual	321.820	17.939					
Day 97							
Fixed effects							
	Estimate	SE	df	t	χ^2	df	p
(Intercept)	210.825	4.915	21.503	42.898			
Maternal social	1.260	6.873	18.242	0.183	0.03	1	0.86

environment							
Own social environment	14.973	6.970	29.798	2.148	4.31	1	0.04
Maternal social environment * own social environment ^a	-12.447	13.816	29.726	-0.901	0.8	1	0.37
Random effects							
	Variance	Std.Dev.					
Maternal ID	63.770	7.985					
Residual	290.630	17.048					
Including only data until day 61 (when most cages were still together):							
Fixed effects							
	Estimate	SE	df	t	χ^2	df	p
(Intercept)	215.200	4.612	35.970	46.656			
Day * maternal social environment * own social environment ^a	0.137	0.635	211.100	0.215			
Day ² * maternal social environment * own social environment ^a	0.015	0.025	211.100	0.628	5.42	3	0.14
Day ³ * maternal social environment * own social environment ^a	-0.001	0.002	211.100	0.633			
Day * maternal social environment ^a	0.235	0.320	211.100	0.735			
Day ² * maternal social environment ^a	-0.010	0.012	211.100	-0.833	0.90	3	0.83
Day ³ * maternal social environment ^a	-9.47*10 ⁻⁴	0.001	211.100	-0.871			
Day * own social environment	0.349	0.321	211.100	1.086			
Day ² * own social environment	-0.008	-0.012	211.100	-0.603	6.05	3	0.11
Day ³ * own social environment	-5.50*10 ⁻⁴	0.001	211.100	-0.505			
Maternal social environment * own social environment	-11.920	6.019	33.010	-1.980	3.78	1	0.052
Day	3.374	0.162	211.100	20.812	<0.001		
Day ²	-0.139	0.006	211.100	-22.127	<0.001		
Day ³	-0.003	5.50*10 ⁻⁴	211.100	-6.064	<0.001		
Maternal social environment	2.455	6.464	33.780	0.380	0.71		
Own social environment	12.700	4.177	31.960	3.041	0.005		
Random effects							
	Variance	Std.Dev.					
Maternal ID : F1 ID^b	75.400	8.683					
Maternal ID	168.620	12.985					
Residual	78.430	8.856					
Post-hoc tests; split by maternal social environment:							
Offspring of pair-housed mothers							
Fixed effects							

	Estimate	SE	df	t	χ^2	df	p
(Intercept)	215.100	5.642	16.790	38.127			
Day	3.245	0.233	107.100	13.931			
Day ²	-0.134	0.009	107.200	-14.773	361.07	3	<0.001
Day ³	-0.003	7.90*10 ⁻⁴	107.100	-3.602			
Own social environment	11.990	3.213	15.000	3.733	10.31	1	0.001
Random effects							
	Variance	Std.Dev.					
Maternal ID : F1 ID ^b	33.720	5.807					
Maternal ID	326.380	18.066					
Residual	82.450	9.080					
Offspring of group-housed mothers							
Fixed effects							
	Estimate	SE	df	t	χ^2	df	p
(Intercept)	218.200	4.080	30.540	53.488			
Day	3.509	0.224	104.000	15.653			
Day ²	-0.145	0.009	104.000	-16.674	356.94	3	<0.001
Day ³	-0.004	7.61*10 ⁻⁴	104.000	-5.501			
Own social environment	-0.166	4.606	21.720	-0.036	0.001	1	0.97
Random effects							
	Variance	Std.Dev.					
Maternal ID : F1 ID ^b	105.100	10.252					
Maternal ID	49.710	7.050					
Residual	73.600	8.579					
Post-hoc tests; split by own social environment							
Pair-housed F1 females							
Fixed effects							
	Estimate	SE	df	t	χ^2	df	p
(Intercept)	211.100	4.114	20.640	51.296			
Day	3.215	0.197	115.000	16.290			
Day ²	-0.136	0.008	115.000	-17.732	398.72	3	<0.001
Day ³	-0.003	0.001	115.000	-4.617			
Maternal social environment	4.514	5.687	17.750	0.794	0.62	1	0.43
Random effects							
	Variance	Std.Dev.					
Maternal ID : F1 ID ^b	116.67	10.801					
Maternal ID	68.99	8.306					
Residual	63.58	7.973					
Group-housed F1 females							
Fixed effects							
	Estimate	SE	df	t	χ^2	df	p
(Intercept)	227.100	6.075	21.570	37.387			
Day	3.564	0.260	96.000	13.707			
Day ²	-0.143	0.010	96.000	-14.231	312.08	3	<0.001
Day ³	-0.004	0.001	96.000	-4.124			

Maternal social environment	-11.110	8.127	17.220	-1.367	1.77	1	0.18
Random effects							
	Variance	Std.Dev.					
Maternal ID : F1 ID^b	67.49	8.215					
Maternal ID	227.08	15.069					
Residual	91.41	9.561					

Estimates are given on the original scale. Maternal and F1 pair-housing is coded as 0, group-housing is coded as 1. Factors included in the final model are presented in bold.

^a estimates and statistics are from the last model that still included the interaction.

^b F1 ID nested within maternal ID.

Table S3. General linear mixed model of effects of the maternal and F1 own social environment on egg mass and offspring mass at hatching.

Effects on egg mass:							
Fixed effects							
	Estimate	SE	χ^2	df	p		
(Intercept)	10.412	0.193					
Maternal social environment * own social environment ^a	-0.115	0.556	0.04	1	0.84		
Maternal social environment	-0.153	0.257	0.35	1	0.55		
Own social environment	0.711	0.278	6.02	1	0.01		
Random effects							
	Variance	Std.Dev.					
Maternal ID : F1 ID^b	0.595	0.772					
Maternal ID	0.000	0.000					
Residual	0.258	0.508					
Including F1 female mass at day 90 as a covariate:							
Fixed effects							
	Estimate	SE	χ^2	df	p		
(Intercept)	6.902	1.341					
Maternal social environment * own social environment ^a	0.003	0.502	0.00	1	0.995		
Maternal social environment	-0.158	0.264	0.33	1	0.56		
Own social environment	0.439	0.275	2.45	1	0.12		
F1 female mass at day 90	0.016	0.006	5.59	1	0.02		
Random effects							
	Variance	Std.Dev.					
Maternal ID : F1 ID^b	0.430	0.655					
Maternal ID	0.091	0.302					
Residual	0.258	0.508					
Effects on offspring mass at hatching:							
Fixed effects							
	Estimate	SE	χ^2	df	p		
(Intercept)	6.926	0.145					
Maternal social environment * own social	-0.261	0.543	0.23	1	0.63		

environment* F2 sex					
Maternal social environment * F2 sex	-0.138	0.262	0.27	1	0.60
Own social environment* F2 sex	-0.115	0.269	0.18	1	0.67
Maternal social environment * own social environment ^a	-0.457	0.413	1.19	1	0.28
Maternal social environment	-0.032	0.199	0.03	1	0.87
Own social environment	0.830	0.211	12.53	1	< 0.001
F2 sex	-0.116	0.131	0.78	1	0.38
Random effects					
	Variance	Std.Dev.			
Maternal ID : F1 ID^b	0.179	0.423			
Maternal ID	2.40*10⁻¹⁶	1.55*10⁻⁸			
Residual	0.228	0.477			
Including egg mass as a covariate:					
Fixed effects					
	Estimate	SE	χ^2	df	p
(Intercept)	-0.675	0.353			
Maternal social environment * own social environment ^a	0.137	0.117	1.36	1	0.24
Maternal social environment	-0.036	0.078	0.21	1	0.65
Own social environment	0.077	0.065	1.39	1	0.24
Egg mass	0.730	0.033	135.61	1	< 0.001
Random effects					
	Variance	Std.Dev.			
Maternal ID : F1 ID^b	0.000^c	0.000^c			
Maternal ID	0.013	0.112			
Residual	0.042	0.205			

Estimates are given on the original scale. Maternal and F1 pair-housing is coded as 0, group-housing is coded as 1. Factors included in the final model are presented in bold.

^a estimates and statistics are from the last model that still included the interaction.

^b F1 ID nested within maternal ID.

^c variance parameters estimated as zero in the model.

Table S4. General linear mixed model of effects of the maternal and F1 own social environment on female plasma hormone levels in the restraint stress protocol and the GnRH challenge.

Female plasma corticosterone levels in the restraint stress protocol:							
Fixed effects							
	Estimate	SE	χ^2	df	p		
(Intercept)	0.364	0.055					
Time of day ^a	0.420	0.762	0.30	1	0.58		
Maternal social environment * own social environment * sample ^a	0.288	0.186	2.32	1	0.13		
Maternal social environment * own social environment ^a	0.008	0.118	0.005	1	0.95		
Own social environment * sample ^a	0.126	0.096	1.69	1	0.19		
Maternal social environment * sample ^a	-0.121	0.092	1.69	1	0.19		
Maternal social environment	-0.056	0.067	0.64	1	0.42		
Own social environment	0.012	0.059	0.04	1	0.85		
Sample	0.451	0.047	53.24	1	< 0.001		
Random effects							
	Variance	Std.Dev.					
Maternal ID : F1 ID^b	0.005	0.072					
Maternal ID	0.008	0.091					
Residual	0.043	0.208					
Female plasma androgen levels in the GnRH challenge:							
Fixed effects							
	Estimate	SE	χ^2	df	p		
(Intercept)	0.751	0.076					
Maternal social environment * own social environment * sample ^a	0.136	0.159	0.72	1	0.40		
Maternal social environment * sample ^a	-0.032	0.069	0.22	1	0.64		
Maternal social environment * own social environment ^a	0.161	0.194	0.55	1	0.46		
Own social environment * sample ^a	-0.079	0.080	0.96	1	0.33		
Maternal social environment	0.020	0.104	0.04	1	0.85		
Own social environment	0.044	0.100	0.17	1	0.68		
Sample	0.223	0.035	26.43	1	< 0.001		
Random effects							
	Variance	Std.Dev.					
Maternal ID : F1 ID^b	0.045	0.213					
Maternal ID	0.018	0.135					
Residual	0.020	0.143					
Including female mass as a covariate:							
Fixed effects							
	Estimate	SE	df	t	χ^2	df	p
(Intercept)	-0.744	0.559	41.512	-1.331			
Maternal social environment * own social environment * sample * F1 body mass ^a	-0.002	0.007	33.208	-0.271	0.07	1	0.79
Maternal social environment * own social environment * F1	-0.007	0.010	33.460	-0.743	0.54	1	0.46

body mass ^a							
Maternal social environment * sample * F1 body mass ^a	-0.003	0.003	33.205	-0.869	0.75	1	0.39
Maternal social environment * own social environment * sample ^a	0.087	0.145	33.714	0.602	0.36	1	0.55
Own social environment * sample * F1 body mass ^a	0.002	0.003	33.206	0.692	0.48	1	0.49
Own social environment * sample ^a	-0.012	0.076	33.677	-0.152	0.02	1	0.88
Maternal social environment * F1 body mass ^a	-0.002	0.005	33.058	-0.497	0.20	1	0.66
Maternal social environment * own social environment ^a	0.074	0.120	34.477	0.370	0.14	1	0.71
Maternal social environment * sample ^a	-0.038	0.062	33.429	-0.612	0.37	1	0.54
Own social environment * F1 body mass ^a	-0.007	0.005	33.987	-1.491	2.15	1	0.14
Sample * F1 body mass	-0.005	0.002	33.230	-2.964	7.80	1	0.005
Maternal social environment	0.030	0.089	34.150	0.332	0.11	1	0.74
Own social environment	-0.046	0.106	34.463	-0.492	0.17	1	0.68
F1 body mass	0.007	0.003	41.387	2.685			0.006
Sample	1.273	0.356	33.220	3.579			0.001
Random effects							
	Variance	Std.Dev.					
Maternal ID : F1 ID^b	0.058	0.241					
Maternal ID	1.17*10⁻¹⁵	3.42*10⁻⁸					
Residual	0.016	0.127					
Post-hoc tests; split by sample:							
Baseline							
Fixed effects							
	Estimate	SE	df	t	χ ²	df	p
(Intercept)	-0.560	0.621	33.440	-0.901			
Maternal social environment	0.037	0.113	17.108	0.326	0.10	1	0.75
Own social environment	-0.005	0.122	29.814	-0.045	0.002	1	0.97
F1 body mass	0.006	0.003	33.770	2.104	3.30	1	0.07
Random effects							
	Variance	Std.Dev.					
Maternal ID	0.015	0.123					
Residual	0.078	0.280					
Post challenge							
Fixed effects							
	Estimate	SE	df	t	χ ²	df	p
(Intercept)	0.531	0.488	33.000	1.089			
Maternal social environment	0.011	0.083	33.000	0.134	0.02	1	0.89
Own social environment	-0.051	0.101	33.000	-0.504	0.25	1	0.62
F1 body mass	0.002	0.002	33.000	0.950	0.89	1	0.35
Random effects							
	Variance	Std.Dev.					

Maternal ID	0.000^c	0.000^c
Residual	0.065	0.237

Estimates for plasma corticosterone levels are given on the log10 scale, estimates for plasma androgen levels are given on the original scale. Maternal and F1 pair-housing is coded as 0, group-housing is coded as 1. The baseline sample (before restraint or the GnRH injection) is coded as 1, the post-restraint/challenge sample is coded as 2. Factors included in the final models are presented in bold.

^a estimates and statistics are from the last model that still included the factor/interaction.

^b F1 ID nested within maternal ID.

^c variance parameters estimated as zero in the model.

Table S5. Generalized linear mixed model of effects of the maternal and F1 own social environment on egg laying rates, fertilization success, hatching success of fertilized eggs and overall hatching rates (the proportion of all eggs collected for the F2 generation that hatched, i.e. including non-fertilized eggs).

Effects on egg laying rates:					
Fixed effects:					
	Estimate	SE	χ^2	df	p
(Intercept)	1.241	0.244			
Maternal social environment * own social environment ^a	-0.071	0.626	0.01	1	0.92
Maternal social environment	0.309	0.327	0.89	1	0.34
Own social environment	-0.105	0.327	0.10	1	0.75
Random effects:					
	Variance	Std.Dev.			
Maternal ID : F1 ID^b	0.008	0.090			
Maternal ID	0.111	0.334			
Effects on fertilization success:					
Fixed effects:					
	Estimate	SE	χ^2	df	p
(Intercept)	1.318	0.313			
Maternal social environment * own social environment ^a	0.721	0.814	0.77	1	0.38
Maternal social environment	-0.673	0.389	2.89	1	0.09
Own social environment	-0.432	0.416	1.08	1	0.30
Random effects:					
	Variance	Std.Dev.			
Maternal ID : F1 ID^b	0.597	0.773			
Maternal ID	0.000^c	0.000^c			
Effects on the hatching success of fertilized eggs:					
Fixed effects:					
	Estimate	SE	χ^2	df	p
(Intercept)	-0.745	0.236			
Maternal social environment * own social environment ^a	0.253	0.716	0.13	1	0.72
Maternal social environment	0.536	0.324	2.63	1	0.11
Own social environment	0.744	0.356	4.07	1	0.04
Random effects:					
	Variance	Std.Dev.			
Maternal ID : F1 ID^b	0.001	0.038			
Maternal ID	0.000^c	0.000^c			
Effects on overall hatching rates:					
Fixed effects:					
	Estimate	SE	χ^2	df	p
(Intercept)	-1.193	0.275			
Maternal social environment * own social environment ^a	0.308	0.633	0.24	1	0.63
Maternal social environment	0.188	0.334	0.32	1	0.57
Own social environment	0.446	0.318	1.88	1	0.17

Random effects:		
	Variance	Std.Dev.
Maternal ID : F1 ID^b	0.000^c	0.000^c
Maternal ID	0.122	0.350

Estimates are given on the logit scale. Maternal and F1 pair-housing is coded as 0, group-housing is coded as 1. Factors included in the final model are presented in bold.

^a estimates and statistics are from the last model that still included the interaction.

^b F1 ID nested within maternal ID.

^c variance parameters estimated as zero in the model.