perimental animals were not shown to deviate from them to any degree.

Conclusion. Supravaginal hysterectomy in the macaque at the time of parturition causes no deviation from the normal pattern in the resumption of ovarian activity as demonstrated by the study of vaginal desquamation.

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Detoxication of Borneol by Glucuronic Acid in Humans.

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In previous studies[1] we had investigated the extent of detoxication of phenylacetic acid and benzoic acid in the form of glucuronides, using the photoelectric colorimetric method of Maughan, Evelyn and Browne.[2] We were attracted to the study of the detoxication of borneol for the reason that the high percentage of detoxication by glucuronic acid of this substance reported in the literature enhanced the possibility of using it to study pathological cases. In this paper we deal with a detailed study of normal cases.

Quick[3] reporting 2 cases in which 2 g of borneol was ingested by human subjects, stated that 81% was excreted as the glucuronide within 10 hours after ingestion; while on giving the subject 3.5 g of borneol, 69% was thus excreted within 6 hours. Pryde and Williams[4] extended these experiments to 24 human cases and measured the excretion of glucuronides for some stated period between 6-12 hours after the ingestion of 2 g of borneol. These authors found that the maximum excretion was around 80%, and that this limit is reached in the normal human being within 10-12 hours. It

* We wish to acknowledge the help of Mr. William Lewanda in carrying out some of the analyses.

1 Wagreich, H., Kamin, H., and Harrow, B., PROC. SOC. EXP. BIOL. AND MED., 1940, **43**, 468; Wagreich, H., Abrams, A., and Harrow, B., *Ibid.*, 1940, **45**, 46.

2 Maughan, G. B., Evelyn, K. A., and Browne, J. S. L., *J. Biol. Chem.*, 1938, **126**, 567.

3 Quick, A. J., *J. Biol. Chem.*, 1928, **80**, 535.

4 Pryde, J., and Williams, R. T., *Biochem. J.*, 1936, **30**, 799.

should be added that both Quick, and Pryde and Williams determined their glucuronides by less convenient reduction methods.[5]

In their paper, Pryde and Williams fail to present analyses of urinary glucuronides for each subject *before* the ingestion of the borneol and *after* the 12-hour period following the ingestion. In order to determine the maximum detoxication, the urine from each subject was collected for a given period (from 6-12 hours), and the urinary glucuronides were determined in the total volume of urine voided. For each subject, therefore, with one exception, only *one* figure is given by Pryde and Williams for the excretion of the glucuronides.

We report, first, the results of 8 subjects (male students, ranging in age from 17-22 years) when fed 2 g of borneol in gelatin capsules. Twenty-four-hour urine samples were collected for 2 days. At the beginning of the third day, the subject ingested 2 g of borneol. The collection of urine was then continued for 3 days.

The average percentage detoxication for these cases with 94% (the range was 79 to 104%), which is somewhat higher than that obtained by Pryde and Williams.

The figures for the fourth and fifth days show that the urinary glucuronides tend to return to the normal range one day after ingestion of the borneol.

Preliminary work with pathological cases convinced us that 2 g of borneol was an inconvenient dose to ingest. We therefore turned to a detailed study of the ingestion of 1 g of borneol, using normal subjects throughout. The experimental procedure was similar to that adopted for 2 g of borneol with this modification: that on the

TABLE I.
Amount of Glucuronic Acid Eliminated on Ingestion of 2 g of Borneol.

Subject	Mg glucuronic acid per 24-hr sample days					Avg mg glucuronic acid per 24 hrs in normal urines†	Increase in mg glucuronic acid on ingestion of 2 g borneol	% detoxication
	1	2	3*	4	5			
A	432	343	2889	455	431	388	2501	99
B	551	497	2993	664	475	524	2469	98
C	418	543	2814	546	348	481	2333	93
D	623	516	3182	541	702	570	2612	104
E	355	572	2890	723	687	464	2426	96
F	477	517	2487	685	559	497	1990	79
G	578	452	2866	557	388	515	2351	93
H	649	629	3099	412	634	639	2460	98

*Ingestion of borneol at the beginning of the third day.
†These figures were obtained by taking the average of the first 2 days.

[5] Quick, A. J., *Ind. Eng. Chem.*, 1925, **17**, 729.

third day—the day of ingestion—the subject collected *5 three-hour samples of urine,* followed by 1 nine-hour sample to complete the collection for that day.

Table II presents the results using 26 normal subjects. Here the results are tabulated in 24-hour intervals. The percent detoxication on the ingestion of 1 g of borneol varies from 60 to 101, with an average of 81. Again, as with the 2 g experiments, the urinary glucuronides return to normal within one day after feeding.

Table III gives the results of the elimination of glucuronides at each 3-hour interval, and the 9-hour interval on the day the subject was fed 1 g of borneol.

Fifty percent of the cases showed a maximum percent detoxication in the second 3-hour interval, while 35% reached a maximum in the third 3-hour period. The amount of glucuronic acid obtained during that 3-hour period in which maximum elimination takes place varies from 412-897 mg with an average of 605 mg.

TABLE II.
Amount of Glucuronic Acid Eliminated on Ingestion of 1 g Borneol.

Subject	Mg glucuronic acid per 24-hr sample, days					Avg mg glucuronic acid per 24 hrs in normal urines†	Increase in mg glucuronic acid on ingestion of 1 g borneol	% detoxication
	1	2	3*	4	5			
1	350	569	1379	338	384	460	919	73
2	366	515	1671	542	510	441	1230	98
3	435	738	1710	711	350	587	1123	89
4	356	509	1557	406	399	433	1124	89
5	546	559	1912	512	487	553	1359	108(?)
6	583	466	1434	550	764	525	909	72
7	603	552	1393	563	814	578	815	65
8	575	528	1698	482	552	552	1146	91
9	318	425	1549	538	475	372	1177	93
10	612	562	1351	558	515	587	764	61
11	577	542	1456	322	560	560	896	71
12	382	398	1192	430	389	390	802	64
13	420	402	1410	394	442	411	999	80
14	326	477	1256	400	411	402	854	68
15	592	424	1282	638	590	508	774	62
16	322	396	1613	455	445	359	1254	100
17	459	384	1391	482	322	422	969	76
18	523	444	1622	680	575	484	1138	90
19	396	492	1398	521	689	444	954	76
20	539	705	1805	645	430	622	1183	94
21	490	410	1722	383	372	450	1272	101
22	585	510	1299	662	600	548	751	60
23	683	970	1728	695	774	827	901	72
24	563	739	1638	608	572	651	987	79
25	397	382	1555	531	304	390	1165	93
26	398	576	1575	572	564	487	1088	87

*Ingestion of borneol at the beginning of the third day.
†These figures were obtained by taking the average of the first 2 days.

TABLE III.
Amounts of Glucuronic Acid in mg Eliminated in Stated Intervals after Ingestion of 1 g of Borneol.

Subject	3-hr intervals					9-hr interval	Hours during which max. production of glucuronides occurred
	First	Second	Third	Fourth	Fifth	Sixth	
1	52	46	223	450	320	288	9-12
2	105	313	729	260	74	190	6- 9
3	300	816	138	—*	199	257	3- 6
4	167	585	351	135	80	191	3- 6
5	187	147	824	281	235	238	6- 9
6	335	329	152	139	189	290	0- 6
7	200	538	208	275	83	89	3- 6
8	183	736	314	120	172	175	3- 6
9	82	597	329	205	110	226	3- 6
10	130	455	221	110	105	330	3- 6
11	73	146	677	175	131	254	6- 9
12	50	64	148	539	194	297	9-12
13	79	779	169	146	86	151	3- 6
14	66	224	412	159	139	256	6- 9
15	173	480	200	103	98	227	3- 6
16	146	306	231	534	146	250	9-12
17	140	52	781	140	98	180	6- 9
18	67	509	367	187	160	332	3- 6
19	112	287	417	156	165	261	6- 9
20	180	381	663	211	97	273	6- 9
21	64	206	897	276	98	181	6- 9
22	256	503	154	117	90	179	3- 6
23	237	590	195	189	195	322	3- 6
24	281	500	282	173	164	238	3- 6
25	194	552	266	145	157	241	3- 6
26	88	395	550	212	195	135	6- 9

*Subject did not void any urine during this period.

The average percentage detoxication which occurs within 15 hours after the ingestion of 1 g of borneol is 78 (the range being from 58 to 100).† Since the average percentage detoxication for a 24-hour period is 81, this indicates that detoxication is almost complete within 15 hours after the ingestion of the borneol.

Summary. (1) The ingestion of 2 g of borneol by 8 normal subjects resulted in the excretion, within 24 hours, of an average of 94% in the form of its glucuronide, the range being from 79 to 104%. (2) The ingestion of 1 g of borneol by 26 normal subjects resulted in the excretion, within 24 hours, of an average of 81%, the range being from 60 to 100%. (3) Fifty percent of the subjects, on ingesting 1 g of borneol, gave a maximum excretion in 3 to 6

† These values were obtained by subtracting $15\frac{1}{4}$ times the average of the daily normals from the values of glucuronic acid obtained by adding the 5 three-hour periods shown in Table III. This value was then divided by the theoretical value, in mg, for 100% detoxication.

hours, while 35% gave it in 6 to 9 hours. (4) The detoxication of 1 g of borneol by the 26 subjects was almost complete in 15 hours, the average value at that time being about 96% of that obtained in 24 hours.

12072

Influence of Lactogenic Preparations on Production of Traumatic Placentoma in the Rat.*

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For several years we have been concerned with the problem of the hormonal factors involved in the establishment and maintenance of pregnancy, hoping ultimately to understand the pituitary factors necessary for nidation and maintenance of pregnancy in the hypophysectomized rat. For the present we have had to limit ourselves to an examination of the factors necessary for maintenance of pregnancy in the precociously matured rat and to an examination of the pituitary factors necessary for the production of *functional* corpora lutea, as judged by the ability to produce deciduomatous tissue in the traumatized endometrium. These studies on the effect of various fractions of the pituitary on placentoma formation will be reported elsewhere[1] *in extenso,* the present paper being limited to the effect of lactogenic preparations.

Evans and Long showed many years ago that the corpora lutea of the normal cyclic rat were non-functional and would not sustain placentomata unless the cycle was prolonged by stimulation of the cervix. They further showed that crude pituitary extracts would also prolong the cycle, and Teel showed that traumatic placentomata could be produced under the latter conditions. It is relatively easy to produce corpora lutea in the ovaries of immature rodents or of hypophysectomized rats with gonadotrophic agents but such corpora lutea like normally occurring cyclic corpora are usually non-functional as judged by the placentoma test.

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1 Evans, H. M., Simpson, M. E., Lyons, W. R., and Turpeinen, K., *Endocrinology,* in press.