

# Female Orgasm Rates are Largely Independent of Other Traits: Implications for “Female Orgasmic Disorder” and Evolutionary Theories of Orgasm

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## ABSTRACT

**Introduction.** The criteria for “female orgasmic disorder” (FOD) assume that low rates of orgasm are dysfunctional, implying that high rates are functional. Evolutionary theories about the function of female orgasm predict correlations of orgasm rates with sexual attitudes and behavior and other fitness-related traits.

**Aim.** To test hypothesized evolutionary functions of the female orgasm.

**Methods.** We examined such correlations in a community sample of 2,914 adult female Australian twins who reported their orgasm rates during masturbation, intercourse, and other sexual activities, and who completed demographic, personality, and sexuality questionnaires.

**Main Outcome Measures.** Orgasm rates during intercourse, other sex, and masturbation.

**Results.** Although orgasm rates showed high variance across women and substantial heritability, they were largely phenotypically and genetically independent of other important traits. We found zero to weak phenotypic correlations between all three orgasm rates and all other 19 traits examined, including occupational status, social class, educational attainment, extraversion, neuroticism, psychoticism, impulsiveness, childhood illness, maternal pregnancy stress, marital status, political liberalism, restrictive attitudes toward sex, libido, lifetime number of sex partners, risky sexual behavior, masculinity, orientation toward uncommitted sex, age of first intercourse, and sexual fantasy. Furthermore, none of the correlations had significant genetic components.

**Conclusion.** These findings cast doubt on most current evolutionary theories about female orgasm’s adaptive functions, and on the validity of FOD as a psychiatric construct. **Zietsch BP, Miller GF, Bailey JM, and Martin NG. Female orgasm rates are largely independent of other traits: Implications for “female orgasmic disorder” and evolutionary theories of orgasm. J Sex Med \*\*,\*\*:\*\*-\*\*.**

**Key Words.** Twins; Genetic Correlation; Function; Dysfunction; Fitness Traits; Female Orgasmic Disorder

## Introduction

Understanding the evolutionary origins and adaptive functions of female orgasm is crucial to understanding human sexuality, particularly the alleged female sexual dysfunction of “female orgasmic disorder” (FOD). Unfortunately, speculative theory and unexamined assumptions about biological normality have been more common than empirical research regarding the functions and dysfunctions of female orgasm [1].

FOD is characterized in *Diagnostic and Statistical Manual of Mental Disorders*, 4th edition (DSM-IV-TR) as a persistent or recurrent delay in, or absence of, orgasm following a normal sexual excitement phase [2,3]. Differential diagnostic criteria specify that delayed or absent orgasm causes marked distress (typically frustration or anger), and must not be due to a general medical condition (such as clitoridectomy or spinal cord damage), drug abuse, side effect of medication (such as selective serotonin reuptake inhibitor [SSRI]

antidepressants), some other mental disorder (such as depression or anxiety), or some other sexual disorder (such as vaginismus or sexual arousal disorder).

These FOD criteria assume that a high rate of orgasm is biological normative for female humans during sexual activity with a partner. This assumption is also revealed by the exclusion criteria, which suggest that a wide range of anatomical, hormonal, physiological, psychological, or interpersonal problems can disrupt the normal operation of a female orgasm system that is assumed to generate orgasms reliably during sexual activity with a partner. However, previous research suggests that a majority (around 60–80%) of women do not reach orgasm reliably during sexual activity with a partner, and around 10% never experience orgasm at all [1,3–5]. As such, there has been considerable skepticism about the medicalization of low orgasm rates as FOD [6–11].

Understanding the evolutionary function(s), if any, of female orgasm would clarify whether difficult or absent orgasm constitutes a genuine biological dysfunction. Lloyd [1] reviews many evolutionary hypotheses concerning female orgasm, but as Judson [12] states in *Nature*: “The sad fact is that, for now, all statements about the evolution of the female orgasm are conjectures in an empirical vacuum. To advance the debate, we need data.” Here, we seek to improve this situation using a large (N = 2,914) community sample of Australian female twins who completed a sexual behavior and attitudes questionnaire. We investigate associations between orgasm rate (during intercourse, other sexual activity, and masturbation) and 19 other traits, including occupational status, social class, educational attainment, extraversion, neuroticism, psychoticism, impulsiveness, childhood illness, maternal pregnancy stress, marital status, political liberalism, restrictive attitudes toward sex, libido, lifetime number of sex partners, risky sexual behavior, masculinity, orientation toward uncommitted sex, age of first intercourse, and sexual fantasy.

Different theories about functions of female orgasm imply different predictions about orgasm rates, including their distribution, heritability, phenotypic correlates, and genetic correlates. For example, the oldest and most standard theory is that female orgasm evolved to strengthen long-term sexual pair bonds, to ensure that offspring receive care from both parents [1,13,14]; oxytocin released during orgasm may promote such pair bonding [15]. The pair bond theory makes several predic-

tions relevant to our data. First, orgasm rates during sex with a partner should show low heritability and low variation across women (i.e., be uniformly high), if they have been subject to stabilizing or directional selection for this function. Second, within this limited range of variation, higher orgasm rates should be positively associated with longer-lasting, more committed relationships, and negatively associated with having many impulsive, risky short-term relationships, which would inhibit pair bonding and paternal investment. Third, if high orgasm rates are adaptive, then difficult or absent orgasm should reflect either biological dysfunction or a mismatch between the ancestral environments in which female orgasm evolved (e.g., in hunter-gatherer groups) and modern environments (e.g., with sexually restrictive values and institutionalized marriage). If dysfunctional, difficult or absent orgasm should be associated with health risk factors such as serious prenatal stress and childhood illness that are known to disrupt other adaptive systems, and with personality traits such as neuroticism and psychoticism that are associated with mental health problems such as depression and schizophrenia [16,17]. Alternatively, if ancestral orgasm rates were uniformly high but today are disrupted by anxiety stemming from sexually restrictive values, then women with more restrictive attitudes toward sex and higher neuroticism (more propensity to anxiety and worry) should have lower orgasm rates.

A variation of the pair bond theory is that the female orgasm serves to reward sexual intercourse and increase sexual motivation [1,18], in turn increasing frequency of intercourse and reproductive success. This variation makes the additional prediction that women with higher orgasm rates during intercourse should have, as a result, higher libido.

Other theories also make predictions relevant to our data. For example, if female orgasm is part of the female mate choice system, evolved to favor high-quality males capable of exciting courtship, foreplay, and copulation, then the optimal orgasm rate should be intermediate (maximally discriminating) rather than uniformly high, and there should be curvilinear relationships between orgasm rate and most other fitness-related traits. Alternatively, if female orgasm is a nonadaptive by-product of the male capacity for ejaculatory orgasm, we would predict wide variability in female orgasm rates (since orgasm is free from direct selective pressure) and near-zero phenotypic and genetic correlations with various fitness-relevant traits

(since genetic association with such traits would imply that female orgasm rate has been subject to those correlated selection pressures).

### Aims

Using our genetically informative twin data, we test these and other associations, both at the phenotypic level and at the genetic level, with the aim of illuminating the evolutionary underpinnings of the female orgasm.

### Methods

#### Participants

Participants were drawn from the Australian National Health and Medical Research Council Twin Registry. To ensure anonymity, informed consent was obtained separately from the questionnaires. Also, twins were asked to make up a 10-digit identification number to be used by both twins of a pair, so that their responses could be linked without researchers knowing their identities. In total, 4,904 individual twins aged from 19 to 52 completed and returned the questionnaire (1,824 male individuals and 3,080 female individuals), a 54% response rate. Further details of the sample, data collection, and zygosity determination are described elsewhere [19]. All data used in this study come from the same questionnaire.

Since we focus here on female orgasm, we analyzed only the data from the 3,080 females. Of these, 74 individuals were excluded from further analysis due to ambiguous zygosity and another three due to missing age data. Three items assessed the participants' openness in answering the questionnaire, the extent to which their responses accurately reflected their true feelings and behaviors, and the extent to which they found the questionnaire offensive. A further 89 participants were excluded because they were "not very open" or "not open at all," their responses reflected their true feelings and behaviors "not accurately at all" or "not very accurately," they found the questionnaire "very offensive," or they did not answer one or more of these items.

This left 2,914 women available for analysis, including 638 identical (monozygotic [MZ]) twin pairs, 345 nonidentical (dizygotic [DZ]) pairs, and 948 individuals who were either part of an opposite-sex pair or whose co-twin did not participate. Their mean age was 31.1 (standard deviation

[SD] = 8.5) at the 1991–92 data collection, so most had reached puberty after the 1960s sexual revolution. Most were white/Caucasian, but they were from a diverse range of educational, occupational, and social class backgrounds.

The zygosity of the same-sex twins was determined during previous studies, based on their responses to standard items about physical similarity and being mistaken for each other. Ambiguous responses had been clarified by telephone call. According to Ooki et al. [20] and Martin and Martin [21], concordance on zygosity between discriminant analyses of questionnaire scores and DNA typing is at least 95%, and telephone clarification will have increased this accuracy.

#### Main Outcome Measures

##### Orgasm Rates

Three self-report questions assessed women's orgasm rates: "When you have sexual intercourse (i.e., during penetration with the penis), how frequently do you have an orgasm?"; "How often do you have an orgasm with your sex partner, in ways other than sexual intercourse (for example, during oral sex)"; "When you masturbate, how often do you have an orgasm". For each orgasm rate question, there were seven response options: "never"; "rarely (less than 20%)"; "fairly often (between 20% and 40%)"; "often (40–60%)"; "usually (60–80%)"; "almost always"; and "always", coded on a 0–6 ordinal scale.

##### Other Measures

Along with orgasm rates, we analyzed 19 other traits that seemed likely to influence sexual responsiveness, to correlate with general genetic fitness and mate value, and/or to have influenced sexual strategies and reproductive success under ancestral conditions. These included Eysenck's personality traits (*Extraversion*, *Neuroticism*, and *Psychoticism*, plus an extra scale, *Impulsivity*), sexually relevant traits (e.g., *marital status*, *number of sexual partners*, *risky sexual behavior*, *orientation toward uncommitted sex*, *age of first intercourse*, *political liberalism*, *restrictive attitudes toward sex*, *libido*, *masculinity*, and *frequency of fantasizing about someone other than partner*), and socioeconomic traits (*education*, *occupation*, and *social class*). We also analyzed two health risk items (*childhood illness* and *maternal stress during pregnancy*) that may predict disruptions in the development of normal sexual physiology. Scales and items used to measure each trait are detailed next.

## Measures

### Personality Traits

Personality traits were measured using the 48-item revised Eysenck Personality Questionnaire (EPQ-R) shortened version [29]. The correct interpretation of the *Lie* of the scale is not clear, and it was intended to measure inaccuracy in self-report. As *Lie* scale scores were not substantively related to any of the orgasm traits ( $R^2 < 0.01$ ), we did not consider it further. This left the 12-item Extraversion, Neuroticism, and Psychoticism scales. We also included a 14-item Impulsivity scale consisting of seven items from the EPQ-R full version plus seven extra impulsivity items [30]. Cronbach's alphas for these scales were 0.88, 0.84, 0.54, and 0.75, respectively, in accordance with findings in other studies (e.g., [29,31]).

### Sexual Traits

*Marital status* was self-reported using the following options: never married, separated, divorced, widowed, remarried, married, or de facto married/living together. The first four responses were coded as "single" and the last three as "married or de facto," yielding a dichotomous marital status variable.

*Lifetime number of sexual partners* was self-reported with the item: "During your entire life, approximately how many men have you had sexual contact with?" Response options were labeled "None," "1 only," "2," "3-5," "6-10," "11-20," "21-50," and "Over 50," with these ordinal categories scored 0 to 7. "Sexual contact" was defined as any activity that made the respondent sexually excited, and in which their genitals made contact with any part of the other person.

*Orientation toward uncommitted sex* was assessed with eight yes/no items asking about the appeal of uncommitted or casual sex, which were summed to form a scale. Cronbach's alpha was 0.80.

*Risky sexual behavior* was assessed with eight yes/no items on a checklist. These dichotomous items can be found in Verweij et al. [32] and were summed; Cronbach's alpha was 0.71.

*Age of first intercourse* was assessed by items requesting the age at which each of a number of sexual activities was first performed—we took the age of first intercourse as being the age of initiation of penile-vaginal intercourse (in any of a number of different sexual positions).

*Frequency of fantasizing about someone other than partner* was assessed by the item "How often do you fantasize about having sex with someone other than current partner." Response options were:

never; once every two or three months; once a month; once every two weeks; once a week; a few times each week; nearly every day; at least once a day. Responses were coded ordinally on a 0-7 scale.

*Masculinity* was assessed by summing six yes/no items regarding the extent to which the participant identifies the opposite sex, e.g., "I often think I would rather be a man"; "I pride myself on being feminine" (reverse-coded); "I feel like part of me is male and part of me is female." Cronbach's alpha was 0.55.

*Political liberalism* (which may predict liberal sexual attitudes) was assessed by self-report of affiliation with one of the following Australian political parties: Labor party, Australian Democrat, Liberal party, National Party, or other. The first two were scored as "liberal," the next two as "conservative," and "other" was scored as missing.

*Restrictive attitudes toward sex* was assessed by summing three yes/no items: "It is better not to have sexual relations until you are married"; "Virginity is a girl's most valuable possession"; "Sexual permissiveness threatens to undermine the entire foundation of civilized society." Cronbach's alpha was 0.65.

*Libido* was assessed by summing three yes/no items: "I think about sex almost every day"; "Sometimes sexual feelings overcome me"; "I only rarely think about sex" (reverse-scored). Cronbach's alpha was 0.55.

### Socioeconomic Traits

*Educational attainment* was coded on a 0-5 ordinal scale with the following categories: 0 (primary school, completed 0-7 years of education, or high school, completed 8-10 years), 1 (high school [completed 11-12 years]), 2 (technical apprenticeship/diploma), 3 (technical college degree), 4 (university degree), or 5 (university postgraduate degree).

*Occupational status* was coded on a 0-4 ordinal scale: 0 (elementary clerical, sales, and service workers and laborers and related workers), 1 (intermediate clerical, sales, and services workers and intermediate production and transport workers), 2 (tradespersons and related workers and advanced clerical and service workers), 3 (associate professionals), or 4 (managers, administrators, and professionals).

*Social class* was coded as relative position (lower, middle, or upper) within each of three classes (working, middle, or upper), with the resulting nine categories condensed to a 0-3

ordinal scale due to a very uneven distribution of responses.

### Childhood Health Issues

Childhood health problems were assessed with two yes/no items: *childhood illness* (“During childhood, did you have any serious or unusual health problems that lasted for a substantial part of your childhood?”) and *maternal stress during pregnancy* (“When your mother has talked about being pregnant with you and your twin, has she ever mentioned very stressful events which happened during that time [i.e., while she was pregnant]?”).

### Analyses

We used maximum-likelihood in modeling procedures in the statistical package Mx [22], which accounts for twin relatedness. Age was used as a covariate in all analyses, effectively partitioning out any variation in the traits that may be due to age [4]. The measures described above were analyzed as raw ordinal data, where it is assumed that thresholds delimiting the different categories overlie a normally distributed continuum of liability. In maximum-likelihood modeling, the goodness of fit of a model to the observed data is distributed as chi-square, and the number of unknown parameters (those to be estimated) is reflected by the degrees of freedom. By testing the change in chi-square ( $\Delta\chi^2$ ) against the change in degrees of freedom, we can test whether dropping model parameters, or constraining them to be equal, significantly worsens the model fit. In this way, we can test hypotheses regarding those parameters.

### Genetic Modeling

This study used the classical twin design [23,24], where variance in traits, and covariance between them, is partitioned into genetic and environmental sources. Note that the proportion of variance in a trait explained by genetic factors represents the broad-sense heritability ( $H^2$ ) of the trait.

Partitioning the phenotypic variance into genetic and environmental components can be achieved because MZ twins share all of their segregating genes, while DZ twins share only half of their segregating genes on average—on the other hand, both MZ and DZ twin pairs share the family environment to the same extent, an assumption that has been validated for personality traits, intelligence, and sexual traits [25–27]. Details of the classical twin design and genetic modeling can be found elsewhere [23,24].

We first estimated heritabilities for each trait individually, including the three orgasm rates and the 19 other traits. Then we looked at bivariate relationships between each of the three orgasm rates and the other traits. First, we calculated the phenotypic correlation between each trait pair across all individuals. If that phenotypic correlation was significantly different from zero, then we estimated the bivariate heritability for that trait pair based on the cross-twin cross-trait correlations for MZ and DZ twin pairs [28].

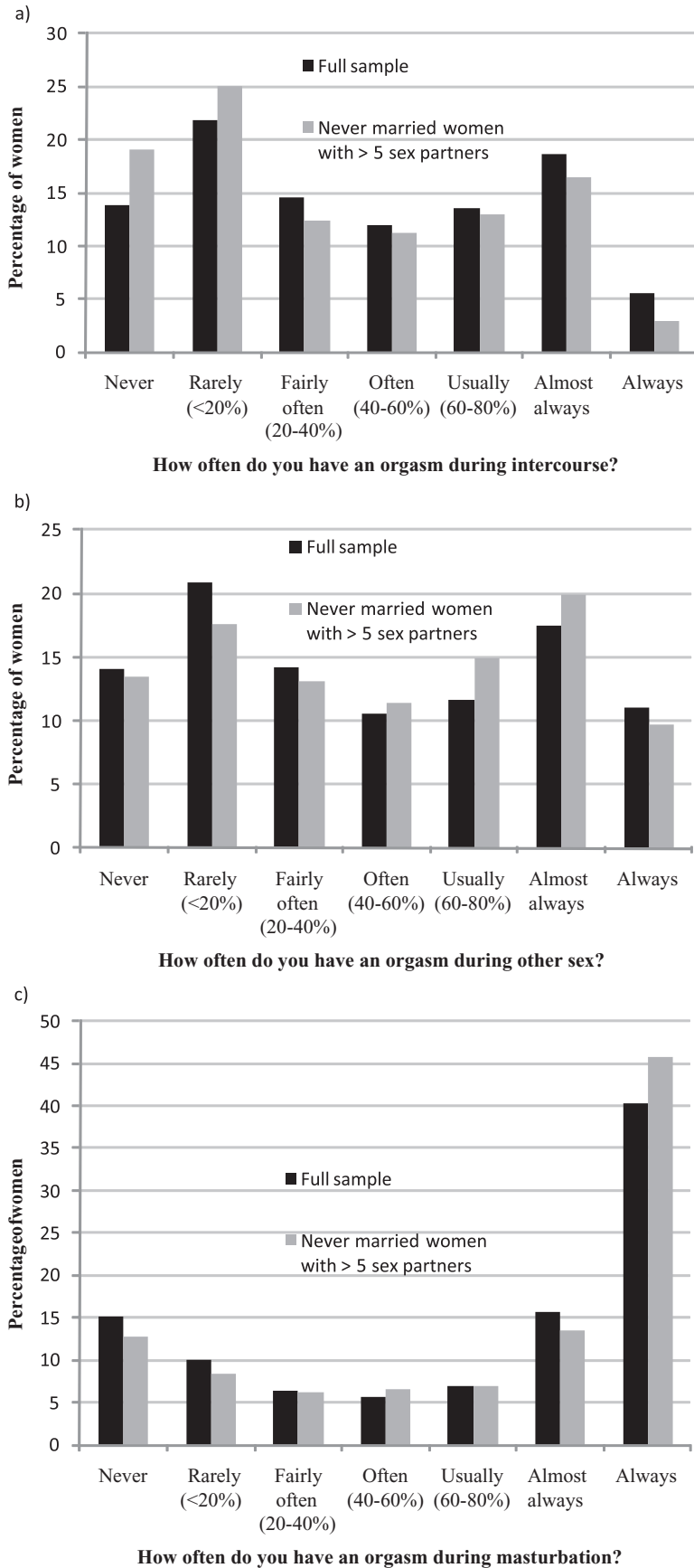
## Results

### Distribution of Orgasm Rates

As a preliminary step, we tested the assumption that MZ and DZ twins do not show mean (threshold) differences in the traits of interest: of the 22 traits (orgasm rates and other traits), only *education* and *masculinity* showed significant threshold differences between MZ and DZ thresholds—in these cases, the thresholds were left free to vary between MZ and DZ twins so that the twin pair correlations were unaffected.

For the 2,914 women in this sample, all three orgasm rates showed a bimodal distribution (see Figure 1, dark bars), with means (and SD) on this 0–6 scale of 3.67 ( $\pm 1.88$ ) for orgasm rate during intercourse, 3.82 ( $\pm 2.01$ ) for orgasm rate during other sexual activities, and 4.87 ( $\pm 2.32$ ) for orgasm rate during masturbation. The distributions of intercourse, other sex, and masturbation orgasm rates were all significantly different—in three bivariate models, equating the thresholds of the different orgasm traits yielded highly significant drops in model fit (in each case,  $\Delta\chi^2 > 80$ ,  $P < 0.0001$ ). Notably, many women reported that they do not masturbate (35%, coded as missing data); further analyses showed that among these women, those who have difficulty reaching orgasm during other sex are overrepresented (but those who have difficulty reaching orgasm during intercourse are not overrepresented).

The distributions for the full sample, described above, include data from many women who were in long-term relationships or who had only one or two previous partners in their life—these women’s reported orgasm rates may refer to sex with only one partner, and so may not reflect their orgasm rates across a range of partners. To check whether the bimodal distributions held for women who were likely to have been reflecting on orgasm rates in general, rather than with one particular partner,



**Figure 1** Frequency distributions of orgasm rates during intercourse (a), other sexual activities (b), and masturbation (c) for 2,914 women. Dark bars refer to the full sample (N=2,914), light bars refer to never married women with more than five lifetime sex partners (N=356).

Figure 1 (lighter bars) also shows the distributions of orgasm rates among never-married women with over five sexual partners ( $N = 356$ ). As can be seen, the distributions are not substantively different from those in the full sample. Note that these women were younger on average ( $M = 25.9$ ) than the full sample, and that in the full sample, there was a significant positive correlation of age with intercourse orgasm rate ( $r = 0.07$ ) and masturbation orgasm rate ( $r = 0.08$ ).<sup>1</sup>

#### Correlations between Intercourse, Other-sex, and Masturbation Orgasm Rate

Intercourse orgasm rate showed only weak correlations with other-sex orgasm rate ( $r = 0.22$ ) and masturbation orgasm rate ( $r = 0.16$ ), but the latter two correlated quite strongly with each other ( $r = 0.50$ ). This is consistent with recent evidence that intercourse orgasm is subjectively and perhaps functionally distinct from the other forms of orgasm [33], and thus, we analyzed the different modes of orgasm separately, instead of treating them as different measures of the same trait.

#### Genetic Modeling of Orgasm Rates

Dawood et al. [4] previously reported a genetic analysis of the variation and covariation of the different modes of orgasm in this data. MZ and DZ twin pair correlations were 0.31 and 0.16 for intercourse orgasm rate, 0.38 and 0.14 for other sex, and 0.51 and 0.34 for masturbation. Genetic modeling revealed that 29–40% of variation in orgasm rates could be explained by genetic variation. Also, the genetic factors influencing other-sex orgasm rate and masturbation orgasm rate were strongly overlapping, whereas the genetic influence on intercourse orgasm was largely independent. See Dawood et al. [4] for detailed results on genetic modeling on orgasm rates in this data. Next, we perform new analyses on 19 fitness-relevant traits in the same data set and whether they are associated (at the phenotypic or genetic level) with orgasm rates.

#### Heritabilities of Other Traits

For each of the other 19 traits, including the personality, sexuality, and socioeconomic traits, we compared the MZ twin correlations to the DZ twin correlations (see the first two columns of Table 1). For all 19 traits, the MZ twin correlation was greater than the DZ twin correlation, and

<sup>1</sup>Note that the direction of these age effects was incorrectly reported for this data in Dawood et al. 2005 [4].

significantly so (at  $P < 0.01$ ) for 11 of them. This suggests widespread genetic influences, and significant heritability (see column 3 of Table 1) for occupational status, social class, extraversion, neuroticism, psychoticism, impulsiveness, lifetime number of sexual partners, restrictive attitudes toward sex, libido, risky sexual behavior, and orientation toward casual sex.

#### Bivariate Modeling of Orgasm Rates with Other Traits

We then moved on to bivariate analyses. We first calculated polychoric phenotypic correlations between each of these 19 traits and each of the three orgasm rates (during intercourse, other sex, and masturbation), shown as the  $r$  values in Table 1. The most dramatic result in this study is that almost all of these phenotypic correlations were close to 0. Although some were statistically significant ( $P < 0.01$ ) due to the large sample size, their absolute magnitudes were rarely much above 0.1—in other words, variation in orgasm rates overlapped with no more than 1% of the variation in most other traits.

Orgasm rate during intercourse showed especially weak correlations with all other traits. Its strongest phenotypic correlation was with libido, but this association was still very weak ( $r = 0.12$ ). For orgasm rate during other sexual activities (such as cunnilingus), the largest correlation was again with libido—this association was stronger but still weak in absolute terms ( $r = 0.20$ ).

For orgasm rate during masturbation, 11 of the 19 phenotypic correlations with other traits were stronger (higher absolute magnitude) than the corresponding correlations for either of the other two modes of orgasm (although all correlations were again weak in absolute terms). The strongest correlations were with sexual traits, including higher orgasm rates during masturbation for women who have a higher lifetime number of sexual partners ( $r = 0.20$ ), engage in riskier sexual behavior ( $r = 0.20$ ), more often fantasize about someone other than their current partner ( $r = 0.20$ ), have less restrictive attitudes toward sex ( $r = -0.17$ ), have higher libido ( $r = 0.18$ ), and have a stronger orientation toward casual sex ( $r = 0.16$ ).

Even where these weak but significant phenotypic correlations existed, they never resulted from significant genetic correlations. For each statistically significant ( $P < 0.01$ ) phenotypic correlation, we calculated the cross-twin cross-trait correlations for MZ and DZ pairs (“MZr ctct” and “DZr ctct” columns in Table 1) and tested whether those

**Table 1** Twin pair correlations (MZr, DZr) and broad-sense heritability estimates ( $H^2$ ) of 19 traits, and the correlation ( $r$ ) of those traits with orgasm rates during intercourse, other sexual activity, and masturbation. Also presented are corresponding cross-trait correlations (MZr ctt, DZr ctt), and bivariate heritabilities (bivar  $H^2$ )

	Orgasm during intercourse			Orgasm during other sex			Orgasm during masturbation		
	MZr	DZr	$H^2$	MZr ctt	DZr ctt	bivar $H^2$	MZr ctt	DZr ctt	bivar $H^2$
Occupational status	0.50	0.24	0.51**	-0.04			0.01		
Social class	0.57	0.41	0.32*	-0.01			0.03		
Educational attainment	0.69	0.58	0.22	-0.09***	-0.12	0.00	-0.03		
Extraversion	0.46	0.22	0.48*	0.09***	0.06	0.00	0.08**		
Neuroticism	0.42	0.21	0.42*	-0.05			0.02		
Psychoticism	0.43	0.13	0.43***	0.05			0.04		
Impulsiveness	0.42	0.18	0.42**	0.06*	0.00	0.04	0.06*	0.12	0.00
Childhood illness	0.23	0.22	0.02	-0.02			-0.02		
Maternal pregnancy stress	0.49	0.45		0.03			0.05		
Married or de facto	0.43	0.42	0.02	0.11***	0.12	0.00	0.00		
Political liberalism	0.76	0.73	0.05	-0.01			0.05		
Restrictive attitudes towards sex	0.58	0.35	0.44*	0.04			-0.09**		
Libido	0.36	0.18	0.36*	0.12***	-0.02	0.01	0.20***	-0.04	0.04
Lifetime number of sex partners	0.61	0.35	0.51***	-0.03			0.06*	0.09	0.04
Risky sexual behaviour	0.54	0.35	0.38**	0.01			0.07	0.05	0.00
Masculinity	0.24	0.11	0.26	-0.07*	-0.01	0.06	0.03	0.08	0.11
Orientation towards uncommitted sex	0.41	0.20	0.41*	-0.05			0.05		
Age of first intercourse	0.58	0.48	0.19	-0.06			-0.10**	-0.07	-0.10
Frequency of fantasizing about someone other than partner	0.33	0.20	0.26	-0.11***	-0.08	0.03	0.07*	0.10	0.11

\* $P < 0.01$ . \*\* $P < 0.001$ . \*\*\* $P < 0.0001$ .



correlations differ significantly from each other. A significantly greater MZ than DZ cross-twin cross-trait correlation indicates significant genetic correlation between the traits. There were no significant genetic correlations between any of the three orgasm rates and any of the other 19 traits. For 10 of the 24 significant phenotypic correlations in Table 1, the corresponding cross-twin cross-trait correlations were actually *lower* in MZ pairs than in DZ twin pairs—the opposite of what would be expected in genetic correlation. This is especially notable given the moderate heritabilities of all three orgasm rates and most of the other traits. Heritable traits are often genetically correlated with other heritable traits, but here, orgasm rates appear to be genetically autonomous.

### *Curvilinear Relationships*

As noted earlier, the mate choice theory of orgasm predicts that there might be some curvilinear relationships between orgasm rate and other fitness-related traits. We inspected plots of all three orgasm rates against raw scores on all the other traits, but no such curvilinear relationships were apparent.

### *Length of Relationships*

If the function of orgasm is to promote pair bonding, we would expect relationships to last longer if women experience higher orgasm rates in those relationships. To test this, we looked at women who reported only one relationship and one lifetime sex partner, since their orgasm rates during sex must refer to sex within that one relationship. In these 588 women, there was no correlation between duration of their relationship and orgasm rates during intercourse ( $r = 0.07$ , *ns*) or during other sex ( $r = 0.03$ , *ns*), controlling for age. A survival analysis (which accounts for the fact that relationships that had not yet ended when the questionnaire was completed might have ended later) also found no significant association between either orgasm rate and relationship length.

## **Discussion**

Analyzing a community sample of 2,914 Australian female twins, we found mostly near-zero correlations between orgasm rates (during intercourse, other sexual activities, or masturbation) and a range of 19 other traits, including socioeconomic, sexual, personality, and health traits, relationship length and status, extraversion, neuroticism, psychoticism, lifetime number of sex partners, prefer-

ence for committed vs. uncommitted sexual relations, risky sexual behavior, sexual fantasy, liberalism/conservatism, restrictive attitudes toward sex, libido, educational attainment, occupational status, and others. Some weak correlations were statistically significant due to the large sample size, but there was no significant genetic component to any of these correlations, even though orgasm rates and most other traits were substantially heritable.

Also, orgasm rates during intercourse and during other sex followed a bimodal distribution, with peaks at “rarely” (less than 20% of the time) and “almost always.” Women achieved orgasm more easily by themselves than with a partner, with “always” as by far the most commonly endorsed response for orgasm rate during masturbation.

These results pose serious problems for all current adaptive evolutionary theories of female human orgasm. For example, if the function of female orgasm is to strengthen sexual pair bonds [13,14], we would expect that women with high rates of orgasm during intercourse or other sex would be generally more oriented toward committed relationships, would have fewer sexual partners in their lifetime, and would show less risky sexual behavior, and that relationships would last longer when the woman had higher orgasm rates during sex. However, the relevant correlations were all close to zero ( $R^2 < 0.007$ ). As others have pointed out, the idea that the women’s orgasm evolved as a pair-bonding mechanism is also difficult to reconcile with comparative data; promiscuous primates including chimpanzees, bonobos, and stump-tailed macaques also exhibit evidence of female orgasms but do not form pair bonds, whereas monogamous pair-bonding female gibbons do not appear to experience orgasm (see [1,34] for reviews).

Pair bonding explanations also conflict with the high prevalence of low or zero rates of orgasm in our data. Thirty-five percent of women rarely or never had orgasms during intercourse or other sex—this is surprising if high orgasm rates with a pair-bonded partner are adaptive and have been positively selected over evolutionary time. A possible counterargument might posit that modern society’s often negative attitudes toward sex may cause anxiety and worry during intercourse that disrupts biologically normal (high) rates of orgasm. However, we would expect this to more strongly affect women with high neuroticism—i.e., those more prone to worry and anxiety in general—and women with restrictive attitudes

toward sex. However, there was no substantive correlation of orgasm rate during intercourse or other sex with either neuroticism or restrictive attitudes toward sex ( $R^2 < 0.009$ ).

Other evolutionary explanations of the female orgasm concern its possible function in mate choice or sperm competition [1,35–38]. These explanations do not suggest that female orgasm rate should necessarily be high, but rather that it should reflect the quality of the sexual partner. Thus, the female orgasm is seen as a discriminatory mechanism that encourages repeated intercourse (or increases fertility) with high-value mates and discourages further intercourse (or decreases fertility) with low-value mates. To function optimally as a discriminator, the “baseline” orgasm rate should be moderate (e.g., roughly 50%), shifting higher with high-quality mates and lower with low-quality mates. For single women reflecting on numerous past sexual partners, we would expect to see a roughly normal frequency distribution with a peak somewhere in the middle (e.g., orgasming 40–60% of the time), and very few women never or always having orgasm during sex. Our data for single women with more than five partners show the opposite, with the peaks being near the edges of the distribution and the trough being in the 40–60% cell (see Figure 1A,B). Also, to the extent that women of higher occupational status, social class, and educational attainment tend to have higher quality mates [39], we would expect those women to have higher rates of orgasm during intercourse or other sex with a partner, but the relevant correlations in our data are all near zero ( $R^2 < 0.009$ ) and most often slightly negative. Overall, although not ideally suited to testing it (e.g., we do not have data on how orgasm rates differ within individuals across different sexual partners or situations), our data appear inconsistent with a mate selection function for the female orgasm.

Given that orgasm during intercourse correlated (slightly) more strongly with libido than any other trait, the possibility arises that the female orgasm functions simply to reward having sexual intercourse, potentially increasing fertility through increasing motivation to have sex [18]. Two issues complicate this interpretation. First, the correlation in question is very weak—only about 1% of variation in libido can be explained by the wide variability in intercourse orgasm rates. Second, libido correlates more strongly with orgasm rate during other sex and masturbation than with orgasm rate during intercourse, imply-

ing a (maladaptive) greater reward-mediated motivation for nonreproductive sex than reproductive sex—consistent with the (maladaptively) higher rates of orgasm during nonreproductive sex. Note that these two complicating issues do not rule out the explanation entirely, since even small selective advantages for orgasm during intercourse could be important over evolutionary timescales, even if orgasm yields stronger subjective rewards for other nonreproductive behaviors.

An alternative possibility is that the human female orgasm does not itself have any important adaptive function but is simply a by-product of evolutionary, developmental, and physiological processes that generate the male orgasm [1,40]—a conceptual analog to male nipples. This by-product explanation would predict wide variability in female orgasm rates and near-zero phenotypic and genetic correlations with various fitness-relevant traits, since genetic association with such traits would imply that female orgasm rate has been subject to those correlated selection pressures. These predictions are largely consistent with our data. Another finding in our data is the slight but significant negative association between masculinity and orgasm rate during intercourse. There is some evidence that prenatal androgen exposure increases the distance between the clitoris and the vagina, and in women, this distance appears to be negatively correlated with orgasm frequency during intercourse [41,42]. If our measure of masculinity (i.e., gender identity) reflects prenatal androgen exposure [43], the slight association between masculinity and intercourse orgasm rate might be explained by this increased clitoris–vagina distance.

As described above, our findings are largely inconsistent with existing functional/adaptive accounts of female orgasm. It is not clear that human female orgasm has a function at all, much less what rates of orgasm would be most functional under particular circumstances. Given this uncertainty, it seems wrong to take difficult or absent orgasm as the principal criterion for having a psychiatric disorder such as FOD. Some women may be frustrated by difficulty achieving orgasm, and of course, sexual medicine should develop the best possible advice, therapies, and medications to help such women [44]. However, classifying such women as psychiatrically disordered seems likely to amplify their anxiety and embarrassment (The fact that American health insurers may not cover orgasm-increasing therapies or drugs unless a patient is diagnosed as suffering from a specific

medical condition should not drive what human experiences we classify as medical conditions).

This study has some limitations that should be addressed in further research. Most importantly, the data are from a twin study that was not designed to test competing theories about adaptive functions of female orgasm. Thus, the measures of orgasm rates could be improved in future studies by asking more numerous and specific questions about orgasm rates with various partners, under various conditions, engaging in various kinds of courtship, foreplay, intercourse, and other sexual activities. For example, when women reported orgasm rates during intercourse in this sample, some may have included orgasms aided by manual stimulation of the clitoris by self or partner, and some may not. Ideally, self-reports of orgasm rates could be supplemented in future research by physiological measures of orgasmic responsiveness. Likewise, our measures of some other traits such as health and masculinity were not optimal. Resulting measurement error could have reduced observed phenotypic and genetic correlations between measures. Future progress will depend on identifying and testing specific predictions about the genetic correlational patterns that would be expected between various physical and psychological traits and orgasm patterns. These orgasm patterns should be measured not just as self-reported lifetime orgasm rates given a few different kinds of sex but as detailed profiles of the factors that may predict orgasm (situations, partner traits, menstrual cycle phase, etc.), the dimensions of the resulting orgasm or non-orgasm experience (perceptual, cognitive, emotional, physiological, hormonal, etc.), and the adaptively relevant outcomes of the experience (with respect to fertility, sexual reinforcement, mate choice, pair bonding, etc.).

### Conclusions

Normal variation in female orgasm rate is large, heritable, and mostly unrelated to other traits. This conflicts with various proposed evolutionary functions of the female orgasm, especially those for which high rates of orgasm are most adaptive (e.g., pair bonding theories). Since it is not clear if the female orgasm has an evolutionary function, let alone what rate of orgasm is most adaptive, perhaps difficult or absent orgasm should not be pathologized in the forthcoming DSM-V the way that it was in DSM-IV-TR as FOD.

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