PERCEPTUAL AND MEMORY BIASES FOR HEALTH-RELATED INFORMATION IN HYPOCHONDRIACAL INDIVIDUALS

HALLE D. BROWN,* STEPHEN M. KOSSLYN,* BETH DELAMATER,² JEANNE FAMA‡ and ARTHUR J. BARSKY§

Abstract—Problematic health concerns characteristic of hypochondriasis may be better understood with the aid of cognitive, information processing theories. We investigated whether hypochondriacal individuals show perceptual and explicit memory biases favoring health-related information. A clinical sample of hypochondriacs (n=18) and healthy controls (n=22), and a sample of hypochondriacal (n=22) and nonhypochondriacal (n=67) patients referred for Holter monitoring, completed a computerized test of perceiving difficult-to-read words and then an encoding task followed by recall of those words. Contrary to our prediction, hypochondriacal individuals in the clinical sample did not perceive more health-related words than words not related to health. Hypochondriacal individuals in the Holter-monitoring sample showed an unexpected bias against reporting health-related words. Social class may account for some of the group differences in this sample. Hypochondriacal individuals in both samples showed better memory for health-related than nonhealth words. © 1999 Elsevier Science Inc.

Keywords: Explicit memory bias; Hypochondriasis; Information processing; Perceptual bias; Social class.

INTRODUCTION

Certain individuals worry about contracting diseases or suffering from physical ailments to such an extent that their lives become centered around these concerns. In the extreme, such health concerns may constitute a diagnosis of hypochondriasis [1]. This disorder is characterized by anxiety about one’s health and/or fear of contracting a life-threatening disease, and by an inability to be reassured by a physician that one has no such disease. The etiology of such health concerns may lie in family pathology, Western cultural preoccupations with health, or stress [2, 3], but at present it is not entirely clear how hypochondriacal behaviors persist despite medical disconfirmation [4]. Hypochondriacal patients pose a problem to the health-care system because they are not medically sicker than other patients seeking care, but are more likely to demand medical attention and costly diagnostic testing [5]. Thus, it is important to study how hypo-
chondriacal individuals come to develop problematic anxieties about health and physical symptoms.

Cognitive, information processing theories are an important component of a multidimensional approach to understanding the etiology of psychiatric disorders, complementing neuroscience and psychopharmacology research. Information processing biases have been documented in individuals with anxiety and depression; anxious individuals preferentially attend to threat-related materials, whereas depressed individuals preferentially remember materials related to negative affect (see refs. 6 and 7). Identification of such biases has lead to the development of objective, behavioral measures of the efficacy of conventional treatment strategies for anxiety disorders [8]. Warwick [9] and Warwick and Salkovskis [10] have begun to apply this approach to hypochondriasis. They developed a cognitive-behavioral model of health anxiety and hypochondriasis that outlines how a belief that physical sensations signal serious illness or disease may lead to anxiety about health, which can then lead to selective cognitive biases favoring information that confirms the illness belief and discounting information that disconfirms it. In support of this model, Barsky et al. [11] have shown that hypochondriacal patients are more likely than other medical patients to attend selectively to, and subsequently amplify, otherwise normal somatic and visceral sensations. Very few studies to date, however, have addressed whether hypochondriacal individuals generally “see the world through a health-related lens.” De Jong et al. [12] investigated reasoning strategies that might distinguish hypochondriacal patients from healthy controls, but did not find evidence that patients were prone to seek out information needed to evaluate hypothetical health threats. However, cognitive hypotheses remain compelling because they account for hypochondriacal symptoms quite well (cf. ref. 13), and because cognitive-behavioral therapy, which targets maladaptive information processing strategies, has shown promise with hypochondriacal patients [14]. Identification of particular maladaptive information processing strategies in hypochondriasis could lead to a better understanding of the nature of this disorder and potentially valuable treatment-evaluation tools.

In this study, we asked whether hypochondriacal individuals preferentially perceive and remember information concerning health. Individuals with hypochondriacal concerns may have a complex of problematic beliefs and attitudes about health and disease in general, and somatic sensations in particular, that constitute, in effect, a cognitive and perceptual “style” [15]. In the parlance of cognitive psychology, beliefs and attitudes are embedded in mental “schemas,” which are data structures that organize information into concepts and narratives in long-term memory (see ref. 16). Schemas can bias information processing by affecting how attention is directed to stimuli, and hence which information is preferentially perceived and subsequently remembered. Specifically, perception of and memory for stimuli that activate schemas should be facilitated because the function of schemas is to process information more efficiently. Moreover, schemas can become highly salient and thus readily assessed over the long term if information is linked to strongly emotional experiences (such as fear). Such a process has been discussed in reference to people who habitually report high levels of physical symptoms [17]. Graf and Mandel [18] distinguished between two types of processing that affect memory: integration and elaboration. Integration is an automatic process that strengthens the coher-
ence of a schema, so that it becomes highly accessible; activation of any part of this mental representation will facilitate activation of the whole concept. Elaboration is a volitional process that strengthens associations between different mental representations, which could expand a schema or link different schemas together. Over time, integrative processing leads to selective encoding of information related to the activated schemas, whereas elaboration leads to facilitated volitional retrieval of information from memory.

Considerations of the possible roles of integrative and elaborative processing suggest at least two distinct types of cognitive biases that could be related to hypochondriasis. First, integrative processing of health-related information might lead hypochondriacal individuals to develop highly accessible schemas concerning health. That is, they may have a *chronic perceptual bias* favoring health-related information. If so, then partial or incomplete information related to health should be filled in and comprehended more quickly than information related to schemas that are less well integrated. We first showed individuals a set of words that were presented in a degraded format, and hence difficult to perceive, and predicted that hypochondriacal individuals would be more adept at identifying words related to health.

Second, individuals with hypochondriacal beliefs may engage in greater elaborative processing for health-related information than nonhypochondriacal individuals, which would facilitate retrieval. That is, they could have an *explicit memory bias* for health-related information. We administered an encoding task in which participants saw each word again clearly, but were not asked to remember the words, and then later asked participants to recall all the words they could remember. We predicted that hypochondriacal individuals would recall more health-related words than words not related to health. Durso et al. [19] studied memory biases for health-related information in a sample of undergraduates scoring high on the MMPI hypochondriasis subscale, but this group did not recall more health information than the control group. They did, however, make errors in recalling the source from which they had acquired the health information.

Initially, we studied a clinical sample of DSM-III-R hypochondriacs and healthy controls recruited from the same medical setting. In addition, we had an opportunity to administer our cognitive tasks to individuals undergoing Holter monitoring for a study of heart palpitations. Although we were not able to administer a clinical interview to this sample, they did complete standard hypochondriasis assessment inventories. Some individuals clearly had “hypochondriacal tendencies”; others in this sample who did not served as controls.

**METHOD**

**Participants**

*Clinical sample.* Volunteers were recruited from a follow-up study of 60 DSM-III-R [20] hypochondriacal patients and 60 healthy control patients who were recruited 5 years prior to the follow-up assessment. Consecutive clinic attenders on randomly selected days were asked to complete a self-report hypochondriasis screening questionnaire (composed of the Whitely Index [21] and the Somatic Symptom Inventory [22]). All participating patients exceeding a predetermined cut-off on the screen, and a random sample of those below it, returned at a later date to undergo the research battery. The latter sample constituted the comparison group. This battery included a structured diagnostic interview, and those who met the diagnostic criteria for hypochondriasis on this interview constituted the hypochondriacal sample. Of these, 18 hypochondriacal (14 women) and 22 healthy control (16 women) patients met diagnostic
criteria for hypochondriasis at the time of follow-up and agreed to participate. Psychiatric comorbidity was not assessed as part of this follow-up study.

Holter-monitoring sample. A total of 104 individuals were recruited from a larger study examining heart palpitations conducted by the same investigators in the same hospital from which the clinical sample was obtained. Consecutive out-patients were referred for continuous, ambulatory, electrocardiographic monitoring to evaluate their complaint of palpitations. Patients were contacted about the study soon after referral. Inclusion criteria were English literacy and fluency, and availability for a follow-up interview. Exclusion criteria were referral from the emergency ward or medical walk-in clinic (because of low rates of compliance with medical follow-up and/or lack of a primary care physician), clinically significant organic brain disease (assessed with the organic mental disorders module of the Diagnostic Interview Schedule [23]), and visual impairment. Consenting participants completed the research tasks after their Holter monitor was put on, but before they received the results. The tasks presented here were administered at the beginning of the battery to avoid priming the individuals with questions about their health. Data for 15 subjects were later removed due to administrative or scoring errors. We divided the sample into nonhypochondriacal (n = 67, 44 women) and hypochondriacal groups (n = 22, 11 women) using the Whiteley Inventory, an index of hypochondriacal behaviors. The hypochondriacal group included those with mean scores per item above 2.5. In our clinical sample, the range of Whiteley scores for the hypochondriasis patients was 2.29–4.64, corroborating that this hypochondriacal group had similar Whiteley scores as our patient group.

Questionnaires
All participants completed questionnaires to assess their demographic characteristics, health care utilization, and hypochondriacal tendencies and symptoms. Social class was determined using the Two-Factor Index of Social Position [24]. Health care utilization was assessed by asking participants how many medical office visits, emergency room visits, hospital admissions, and nights spent in a hospital they had in the 12-month period preceding their research appointment. We assessed hypochondriacal symptoms with the Whiteley Inventory [21, 22] and assessed additional hypochondriacal tendencies with the Somatic Symptom Inventory (SSI [25, 26]), the Somatosensory Amplification Scale (SSAS [27, 28]), and the Somatic Absorption Scale, which was derived from Tellegen’s Absorption Scale [29, 30].

Materials
We constructed four sets of 15 words, two related to health and diseases of great concern to most hypochondriacal individuals (cancer and heart disease), and two not related to health (government and school). We obtained ratings from 108 patients waiting to see their doctors in a primary care medical clinic on how frequently each word was encountered, how easily each word could be defined, and how easily the object named by each word could be visualized. Because of time constraints, each individual rated the 60 words on a seven-point scale for only one dimension (36 raters per dimension). Ten words per category were selected by matching categories on the basis of these ratings and word length (see Appendix). Two versions of each word were created, one intact and one perceptually degraded (75% of the pixels removed).

Procedure
Two tasks were administered to each subject individually on a Macintosh LCII computer using the MacLab software [31] to control stimulus presentations and record responses. Instructions appeared on the computer screen immediately prior to each task. Words were presented sequentially in the center of the screen in 36-point Helvetica font. Participants were 60 cm from the screen, with distance maintained using a chin rest.

Chronic perceptual bias task. Words were presented in one of four random orders, counterbalanced across participants. Each trial began with a fixation dot in the center of the screen for 500 milliseconds (ms), followed by a perceptually degraded word appearing for 500 ms, which the participant was instructed to read aloud. The next trial was initiated 750 ms after the research assistant pressed a key to indicate the type of response (correct, incorrect, or no response). The task began with three practice trials.

Explicit memory task. Participants then saw the words again, in a nondegraded form, for 500 milliseconds, and rated each on a seven-point scale according to how often they saw or heard the word in the news. They were not asked to remember the words. Words were presented in one of four random orders, counterbalanced across participants, and in a different order from that used in the perceptual task. Immediately following completion of the encoding task, participants were given 7 minutes to list as many of the words as they could remember.
RESULTS

Two (group) × two (word type) analyses of variance (ANOVAs) were conducted for each task. With planned contrasts we tested whether hypochondriacal patients, but not nonhypochondriacal individuals, showed perceptual and memory biases favoring health words. We also performed analyses of covariance (ANCOVAs) to control for demographic differences between the groups, which was preferable to matching as that would have reduced power. We tested medical utilization factors as covariates as well because the number of recent experiences with a medical setting per se could affect cognitive biases for health-related words. We planned to perform an ANCOVA whenever we found a significant group × word type interaction to examine the extent to which group differences in biases for health-related words were influenced by other factors.

Demographic and questionnaire data

Means for demographic, health care utilization, and questionnaire variables for each group are presented in Table I. Groups within each sample differed significantly on some of these variables as indicated by t-tests (p > 0.05 if no significance is indicated in the table). In the clinical sample, the factors that differentiated groups, and thus were considered potential covariates, were: age; social class; and number of visits to a doctor’s office in the past year. In the Holter-monitoring sample, the factors tested as potential covariates were: age; social class; and number of nights spent in the hospital in the past year.

Chronic perceptual bias

We examined two different types of dependent measures to assess chronic perceptual bias (and thus adjusted our a level to 0.025 using the Bonferroni procedure). First, we considered the number of words (health vs. nonhealth) correctly identified. Many participants were reluctant to make a guess for some of the degraded words, so we also examined the number of trials for which any viable response was offered (including incorrect guesses) to see whether errors of omission might constitute a systematic reporting bias for one type of words.

Overall percent correct. In the clinical sample, hypochondriacal individuals and controls correctly identified comparable numbers of health and nonhealth words (F<1, η=0.04 for the interaction of group × word type; see Fig. 1). Hypochondriacal patients showed a trend for correctly identifying more words in general (66.0%) than nonhypochondriacal individuals (56.4%) [F(1, 38)=3.10, p=0.086].

The hypochondriacal group in the Holter-monitoring sample correctly perceived fewer degraded health than nonhealth words, whereas the control group showed the opposite pattern [F(1, 65)=4.34, p=0.031 for the control group, p>0.1 for the hypochondriacal group]. No main effects were significant (F<1). The group difference in perceiving health relative to nonhealth words remained significant when controlling for age [F(1, 82)=6.69, p=0.012] and medical utilization [F(1, 82)=6.34, p=0.014]. However, when controlling for social class, the groups no longer differed in a perceptual bias
Table I.—Demographic, health care utilization and questionnaire data for the clinical and Holter-monitoring samples

<table>
<thead>
<tr>
<th>Variable</th>
<th>Clinical sample</th>
<th>Holter-monitoring sample</th>
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<tbody>
<tr>
<td></td>
<td>Hypochondriacal</td>
<td>Nonhypochondriacal</td>
</tr>
<tr>
<td></td>
<td>(N = 18)</td>
<td>(N = 22)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>47.17 (2.34)</td>
<td>58.18 (3.08)$^d$</td>
</tr>
<tr>
<td>Social class$^a$</td>
<td>3.89 (0.21)</td>
<td>2.23 (0.20)$^f$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.68 (0.27)</td>
</tr>
<tr>
<td>Health care utilization</td>
<td></td>
<td>2.76 (0.14)$^f$</td>
</tr>
<tr>
<td>Doctor's office$^b$</td>
<td>14.94 (4.08)</td>
<td>3.68 (0.52)$^f$</td>
</tr>
<tr>
<td>Emergency room$^b$</td>
<td>0.67 (0.24)</td>
<td>0.27 (0.12)</td>
</tr>
<tr>
<td>Hospital admits$^b$</td>
<td>0.44 (0.14)</td>
<td>0.14 (0.10)</td>
</tr>
<tr>
<td>Nights in hospital$^b$</td>
<td>17.17 (14.97)</td>
<td>0.23 (0.23)</td>
</tr>
<tr>
<td>Questionnaires</td>
<td></td>
<td>4.18 (1.94)</td>
</tr>
<tr>
<td>SSI$^c$</td>
<td>2.82 (0.12)</td>
<td>1.57 (0.09)$^f$</td>
</tr>
<tr>
<td>Amplification$^c$</td>
<td>3.29 (0.16)</td>
<td>2.29 (0.12)$^f$</td>
</tr>
<tr>
<td>Absorption$^c$</td>
<td>3.78 (0.08)</td>
<td>3.14 (0.09)$^f$</td>
</tr>
<tr>
<td>Whiteley score$^c$</td>
<td>3.28 (0.16)</td>
<td>1.42 (0.07)$^f$</td>
</tr>
</tbody>
</table>

Standard error of the mean in parentheses.
$^a$ Scored on a five-point scale using the Hollingshead index (1 = highest, 5 = lowest).
$^b$ Number of visits within the past year.
$^c$ Mean rating per item on five-point scales (1 = lowest, 5 = highest).
$^d$ $p < 0.05.$
$^e$ $p < 0.01.$
$^f$ $p < 0.001.$
favoring health words $[F(1, 82)=2.35, p=0.13]$. The perceptual bias against reporting health-related words was more pronounced in lower social class individuals, and more of these individuals were in the hypochondriacal group.

**Reporting biases.** In the clinical group, hypochondriacal patients showed a trend for offering a viable response on fewer health compared to nonhealth trials $[F(1, 17)=5.00, p=0.039]$ (see Fig. 2), but the control group showed no such trend, $(F<1)$. The group×word type interaction was not significant in this sample $(p>0.2; \eta=0.17)$, but it was in the Holter-monitoring sample $[F(1, 66)=12.66, p<0.001, \eta=0.40]$. The hypochondriacal group in the Holter sample reported fewer viable
words for health compared with nonhealth trials \(F(1, 15)=7.52, p=0.015; \text{see Fig. } 2\), but the control group did not \((p>0.2)\). There was a word-type main effect in the Holter sample, with more viable responses given for nonhealth words (87.79%) than for health-related words (86.84%) \(F(1, 66)=6.98, p=0.01\).1

The group difference in offering a viable response for health compared to non-health words in the Holter sample remained significant when controlling for medical utilization \(F(1, 64)=7.10, p=0.01\), and a trend remained when controlling for age \(F(1, 62)=3.46, p=0.068\).2 However, when controlling for social class, the group difference was no longer significant \(F(1, 82)=1.87, p=0.18\). The reporting bias against health-related words in the hypochondriacal group was thus related to the fact that this group was, on average, lower in social class than the nonhypochondriacal group.

**Explicit memory**

We compared recall scores for health vs. nonhealth words within each group; the significance criterion here was \(\alpha=0.05\). In both samples, the hypochondriacal group recalled significantly more health than nonhealth words \(F(1, 17)=6.63, p<0.05\) for the clinical sample; \(F(1, 21)=5.14, p<0.05\) for the Holter sample; \text{see Fig. 3}, but the control group did not \((p>0.2\) for both samples). The group \(\times\) word type interaction was not significant in either sample \((p>0.1)\). In general, more health than nonhealth words were correctly recalled in both the clinical \(F(1, 38)=5.49, p<0.05\) and Holter \(F(1, 87)=3.80, p=0.054\) samples.

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1 Data for 6 hypochondriacal individuals and 15 controls that were missing in this analysis because this information had not been coded at the outset of the study.

2 We initially found that age appeared to be a significant covariate \(F(1, 64)=4.20, p=0.045\), but we were suspicious because age was not correlated with the dependent measure \(r=-0.10, p=0.43\). We thus inspected the raw data for age outliers and found that two individuals, one 70-year-old in the control group and one 71-year-old in the hypochondriacal group, reported far fewer words than all the other subjects. With these two outliers excluded, the groups still differed significantly in the bias against reporting health words \(F(1, 64)=13.5, p<0.001\).
DISCUSSION

We did not find strong support for our hypotheses that hypochondriacal individuals would show perceptual and memory biases favoring health-related information. We found some evidence for explicit memory biases favoring health words in the hypochondriacal groups. This pattern is consistent with the hypothesis that hypochondriacal individuals elaborately process information related to health, perhaps by consciously ruminating on this type of information more than other types of information. Contrary to our prediction, hypochondriacal individuals in the Holter-monitoring sample showed perceptual biases against reporting health words relative to words from neutral categories. That is, hypochondriacal individuals committed more errors of omission for health than for nonhealth words, whereas the nonhypochondriacal group correctly reported similar numbers of each. However, we could not replicate this effect in the clinical sample, although means were generally in the same direction in the two samples.

A bias against reporting health words, although unexpected, nonetheless supports the claim that hypochondriacal individuals may have highly integrated schemata pertaining to health. We know that health words were not simply harder to perceive, because the control groups did not differ in accuracy or reporting frequency for health compared to nonhealth words, and the words had been rated and matched in advance on a number of dimensions related to perceptibility. Rather, such avoidance is reminiscent of the phenomenon of perceptual defense, an unconscious “shielding mechanism” against anxiety-provoking material [32]. Perceptual defense is demonstrated as greater errors identifying perceptually degraded threatening or taboo words relative to neutral words, even though galvanic skin responses to the threatening words occur, indicating that they were recognized at some level. York and colleagues [33] proposed that the effect occurs when an individual is shown materials that are emotionally charged and threatening for that individual. The bias we found against reporting health-related items warrants further investigation; in particular, it would be useful to measure hypochondriacal individuals’ ratings of and autonomic responses to health materials. Although the causes of perceptual defense are not fully understood [33], further demonstration of such behavior in hypochondriasis could have important implications for understanding why some hypochondriacal individuals are not reassured by their physician’s reports. For example, some aspects of discussing one’s health status with the physician could be so threatening that the specific details, such as neutral test results, are not fully comprehended. Yet, we also found explicit memory biases favoring health information, which suggests that some aspects of such information are likely to be ruminated upon by hypochondriacal individuals. Further study is needed to clarify how the patterns of cognitive biases we found could lead to problematic hypochondriacal symptoms.

In particular, it will be important in future studies to explore further whether the theory of perceptual defense is an adequate model for cognitive biases associated with hypochondriasis, or whether selective attention favoring threat cues that is characteristic of anxiety disorders (see ref. 34) is a better model. Neither model, however, predicts explicit memory biases; anxious individuals typically do not show memory biases, although depressed individuals do. Further study of integrative and elaborative processing in hypochondriasis, with larger samples than those employed here, is clearly needed, with the same cognitive tasks used to study attention and
memory biases in anxiety and depression (see refs. 7, 35–37), and careful assessment of comorbidities. In addition, ratings of the threat value of stimulus materials should be obtained so that we may learn whether only one category of information (e.g., words related to diseases such as cancer and heart disease) is considered threatening to hypochondriacal individuals. That is, it would be useful show a double dissociation between patients with illness worries versus patients with other types of anxieties, and information processing biases associated with physical illness versus other types of worries. Then, we could better understand whether the type of results we found here are generally consistent with a current body of research showing that information processing biases for particular domains match the particular concerns of the clinical group (e.g., ref. 38).

In the Holter-monitoring sample, group differences were confounded by demographic factors, particularly social class. These confounds are meaningful, however, in that hypochondriacal individuals did tend to come from lower socioeconomic backgrounds, on average, compared with nonhypochondriacal individuals; their cognitive performance must be evaluated in this light. At least two important implications arise from these results. The first is that clinicians should consider the role that social class background, particularly education level, might play in somatizing. Second, researchers testing the cognitive-behavioral model of hypochondriasis [10] might consider studying the impact of social class background on their measures. Studies of cognitive biases in psychiatric populations typically use small samples and do not systematically investigate these potentially important within-group differences.

The magnitude of cognitive biases we found here was quite small, suggesting that information processing biases are likely only one piece of the puzzle as to why hypochondriacal individuals have such problematic health concerns. Nonetheless, given that cognitive-behavioral therapy, which has shown promise for some hypochondriasis patients [14], focuses in large part on problematic thought patterns, further investigation into the nature of hypochondriacal cognitions is warranted.

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Table AI.—Words used as stimuli

<table>
<thead>
<tr>
<th>Health</th>
<th>Nonhealth</th>
</tr>
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<tbody>
<tr>
<td>Cancer</td>
<td>Court</td>
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<tr>
<td>Mammogram</td>
<td>Algebra</td>
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<tr>
<td>Lump</td>
<td>Veto</td>
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<td>Tumor</td>
<td>Capitalism</td>
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<tr>
<td>Chemotherapy</td>
<td>Democracy</td>
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<td>Election</td>
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<td>Cancer</td>
<td>Biology</td>
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<td>Biopsy</td>
<td>Governor</td>
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<td>Spelling</td>
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<tr>
<td>Incurable</td>
<td>Lobbyist</td>
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<td>Chemistry</td>
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<tr>
<td>Angina</td>
<td>Amendment</td>
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<td>Heart</td>
<td>Literature</td>
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<td>Constitution</td>
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<td>Geometry</td>
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<tr>
<td>Governor</td>
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<td>History</td>
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<td>Palpitation</td>
<td>Accounting</td>
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<td>Astronomy</td>
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