bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

Targeted DNA transposition using a dCas9-transposase fusion protein

Shivam Bhatt and Ronald Chalmers*

School of Life Sciences,
University of Nottingham,
Queen's Medical Centre,
Nottingham NG7 2UH,
UK

*To whom correspondence should be addressed.
Email: chalmers@nottingham.ac.uk

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

SUMMARY

Homology directed genome engineering is limited by transgene size. Although DNA transposons are more efficient with large transgenes, random integrations are potentially mutagenic. Catalytically inactive Cas9 is attractive candidate for targeting a transposase fusion-protein because of its high specificity and affinity for its binding site. Here we demonstrate efficient Cas9 targeting of a mariner transposon. Targeted integrations were tightly constrained at two adjacent TA dinucleotides about 20 bp to one side of the gRNA binding site. Biochemical analysis of the nucleoprotein complexes demonstrated that the transposase and Cas9 moieties of the fusion protein can bind their respective substrates independently. In the presence of the Cas9 target DNA, kinetic analysis revealed a delay between first and second strand cleavage at the transposon end. This step involves a significant conformational change that may be hindered by the properties of the interdomainal linker. Otherwise, the transposase behaved normally and was proficient for integration in vitro and in vivo.

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

INTRODUCTION

Biotechnology and medicine are increasingly reliant on our ability to engineer the mammalian genome. Lentiviruses are useful because gene-delivery across the cell membrane is efficient and integration of the viral genome provides long-term transgene expression. However, they are mutagenic because they integrate at random sites using a mechanism similar to the cut-and-paste transposons. An alternative strategy for ex vivo applications is to establish genomic safe-havens for site-specific recombinases such as the phage C31 integrase or the Cre recombinase (Branda and Dymecki, 2004; Song and Palmiter, 2018). This approach lacks flexibility because it is limited to transgene integration at a predetermined site.

Scar-less engineering of a target site must rely on the cells homologous recombination machinery. Although desired modifications can be made very precisely, the events are rare and difficult to recover. One way to boost the rate of recombination by orders of magnitude is to make a DNA double strand break at the target site (Urnov et al., 2005). This can be achieved using zinc finger nucleases and transcription activator-like effector (TALE) nucleases, which can themselves be engineered to target a user-defined site (Chandrasegaran and Smith, 1999; Zhang et al., 2011). Two significant problems are the extended lead-times and off-target cleavages. TALE and zinc finger nucleases have now been largely superseded by the Cas9 nuclease. It can be programed to target a 20 bp recognition sequence, simply by providing a matching guide RNA (gRNA). Off-target cleavage is relatively low and the long recognition sequence provides ample specificity. However, homologous recombination remains a limiting factor because the efficiency falls off as the transgene size increases (Li et al., 2014).

Transposon vectors are widely used for gene delivery applications (Grabundzija et al., 2010; Lamberg et al., 2002; Liang et al., 2009; Mates et al., 2009; Way et al., 1984). Although their efficiency falls off as the cargo

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

size is increased, they are less sensitive to this parameter than host-mediated homologous recombination (Balciunas et al., 2006; Claeys Bouuaert et al., 2013; Ding et al., 2005; Izsvak et al., 2000; Lohe and Hartl, 1996). However, like the Lentiviruses, transposon vectors are mutagenic because the integration sites are essentially random.

To combat random integration various groups have used site-specific DNA binding proteins to target specific loci. Examples include Mos1, Sleeping Beauty, piggyBac and ISY100, which were variously fused to zinc finger proteins, TALEs and Gal4 (Feng et al., 2010; Ivics et al., 2007; Luo et al., 2017; Maragathavally et al., 2006; Owens et al., 2013; Yant et al., 2007). Although successful, targeting strategies have all me with significant problem: namely, that the transposases are still capable of random integration. Since, DNA binding proteins, such as zinc fingers and TALEs, spend most of their time searching for their binding sites, targeted integrations are recovered against a background of random events. To tackle this problem we are currently developing a switchable transposase, which allows control over the timing of integration. In parallel, we were considering the advantages of potential targeting moieties. Cas9 is an obvious and attractive candidate because extensive base pairing with the target provides a dwell time of several hours (Ma et al., 2016). In contrast, DNA binding proteins remain bound to their specific sites only for a matter of seconds or minutes.

Previously, there was an unsuccessful attempt to use a catalytically inactive Cas9 (dCas9) to target piggyBac insertions to a hypoxanthine phosphoribosyl transferase (HPRT) gene in human cells (Luo et al., 2017). Surprisingly, instead of targeting the HPRT locus, the dCas9-piggyBac chimera protected it from insertions. We therefore set out to test whether Cas9 is a general inhibitor of transposition or whether the effect is peculiar to piggyBac. The choice of the transposase moiety is limited by several factors. Although Tn5 is very active in vitro, and is used extensively in bacteria, it transposes poorly in mammalian cells (Blundell-Hunter et al., 2018). Sleeping Beauty is efficient

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

in vivo but lacks an in vitro system (Mates et al., 2009). While piggyBac is probably the most efficient for gene delivery in vivo, it has a poor in vitro system (Liang et al., 2009; Mitra et al., 2008), which precludes the development of advanced applications such as direct delivery of transpososomes.

Our model system is based on Hsmar1, a reconstituted mariner-family transposon (Miskey et al., 2007; Robertson and Zumpano, 1997). Although it is not as active as piggyBac or Sleeping Beauty in cell culture transfection experiments, the reaction is 100% efficient in vitro (Claeys Bouuaert and Chalmers, 2017). Furthermore, if the mariner transpososome is assembled in vitro, it can be delivered cells directly (Trubitsyna et al., 2017). Hsmar1 also has much lower non-specific nuclease activity than other mariner elements such as Mos1, Mboumar1 and Himar1 (Claeys Bouuaert and Chalmers, 2010; Dawson and Finnegan, 2003; Lampe et al., 1996; Lipkow et al., 2004; Munoz-Lopez et al., 2008; Trubitsyna et al., 2015).

MATERIALS AND METHODS

DNA oligonucleotides and most dry chemicals were from Sigma Aldrich. Enzymes were from New England Biolabs and DNA purification kits were from Qiagen. The nucleotide sequences of all plasmids used in this work are given in Supplemental Table 1. The β-galactosidase assays were as described by Miller (Miller, 1972). LB agar indicator plates contained 40 µg/ml X-gal, when present, .

For in vivo assays, dCas9 was expressed from derivatives of plasmid pdCas9 (Bikard et al., 2013). When present, CRISPR spacers were cloned into the BsaI site as oligoduplexes (Supplemental Table 2). The Hsmar1 transposase gene was added to the 5'- or 3'-end of the dCas9 gene by PCR using pdCas9 and pRC880 as templates: transposase-dCas9, pRC2302; dCas9-transposases, pRC2303. An oligoduplex encoding spacer-7 was cloned into

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

the CRISPR locus of these plasmids to produce pRC2304 and pRC2305, respectively. The native wild type transposase was expressed from pRC2306, which is identical to pdCas9 except that the dCas9 gene is replaced by the transposase gene.

The transcription-strength series of expression vectors for Figure 2C, D was created using the constitutive promoters described by Tellier and Chalmers (Tellier and Chalmers, 2018). In the plasmid with the strongest promoter, P4 (pRC2309), the native S. pyogenes Cas9 promoter in pdCas9 was replaced by Tellier-P2. In plasmid P3 (pRC2308) the S. pyogenes promoter was replaced by Tellier-P1. In plasmid P2 (pRC2307) the S. pyogenes promoter was deleted by inverse PCR and residual transcription was from a cryptic promoter(s). The plasmid with the lowest level of transcription, P1 (pRC2311), was created by replacing the multi-copy origin-of-replication in plasmid P3 (above) with a single-copy origin-of-replication from a bacterial artificial chromosome vector.

Hsmar1 transposase was expressed from pRC880 and purified as a maltose binding protein (MBP) fusion by affinity chromatography as described (Claeys Bouuaert and Chalmers, 2010; Claeys Bouuaert et al., 2011). The expression vector for the dCas9-transposase fusion protein was pRC2303 described above.

The dCas9-transposase fusion-protein was expressed from the constitutive promoter in pRC2303. The plasmid was transformed into E. coli NiCo21 (New England Biolabs). A single colony was picked into a starter culture of LB-Lennox supplemented with 30 µg/mL chloramphenicol and grown at 37°C for 16 hours with shaking at 250 rpm in a baffled Erlenmeyer flask. The culture was diluted 1:100 into fresh media and growth was continued until the OD600 reached 0.5. The temperature was then reduced to 18°C and the incubation was continued for 16 hours. Cell (500 ml) were harvested by centrifugation at 4ºC and resuspended in 40 ml binding buffer (20 mM Tris, pH 8.0, 5 mM imidazole, 0.5 M sodium chloride, 2 mM DTT). All subsequent

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

steps were carried out at 4ºC. Cells were lysed by five passes through a French pressure cell at 16,000 psi and the extract was clarified by centrifugation at 40,000 x g for 30 minutes. The clarified extract was applied to a 1 mL HisTrap HP column (GE Life Sciences) on an AKTA FPLC (Amersham Pharmacia). The column was equilibrated with binding buffer and loosely bound proteins were eluted with 40 column volumes of wash buffer (20 mM Tris at pH 8.0, 60 mM imidazole, 0.5 M sodium chloride, 2 mM DTT). The column was then developed with a 20 column-volume linear-gradient up to 1 M imidazole. Peak fractions were pooled an analyzed by SDS polyacrylamide gel electrophoresis (Supplemental Figure 1). When required for in vitro reactions, the sgRNA and Cas9-transposase were assembled into a ribonucleoprotein complex by incubating for 20 minutes at room temperature in dCT binding buffer (20 mM HEPES pH 7.5, 250 mM potassium chloride, 2 mM MgCl2, 0.01 % Triton X-100, 0.1 mg/mL BSA, 10% glycerol) (Anders et al., 2015). This was done every time it was required immediately before it was used.

The EMSA binding buffers for the native transposase and the dCas9-transposase were, respectively, [20 mM HEPES at pH 7.5, 100 mM NaCl, 2 mM DTT, 10 % glycerol, 5 % DMSO, 5 mM CaCl2, 250 µg/ml BSA] and [20 mM HEPES pH 7.5, 250 mM potassium chloride, 2 mM MgCl2, 0.01 % Triton X-100, 0.1 mg/mL BSA, 10% glycerol]. Reactions (20 µl) contained 10 nM of a Cy-5 labeled oligoduplex encoding either the transposon end or the target of the sgRNA (Supplemental Table 3). After addition of the dCas9-sgRNA-transposase complex, the reactions were incubated for 20 minutes at 37ºC. Binding reactions with the native transposase were incubated for 60 minutes at room temperature to be consistent with our previous work. Binding reactions were loaded onto a TBE buffered 7% polyacrylamide gel and electrophoresed at 120 V. Gels were recorded on a GE Typhoon imager.

In vitro transposition reactions were performed as described (Claeys Bouuaert and Chalmers, 2010). The reaction buffer contained 25 mM Tris-HCl at pH 8.0, 5% glycerol, 100 mM sodium chloride, 2 mM DTT, 2.5 mM MgCl2 and 6.5

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

nM of supercoiled pRC650 as substrate. Transposition reactions (50 µl) were initiated by the addition of transposase and incubated for 4 h at 37ºC. Reactions were made 0.4% in SDS and 19 mM in EDTA and heat inactivated at 75ºC for 30 minutes. Samples (35 µl) were electrophoresed on a TBE buffered 1.1% agarose gel at 60 V for 16 – 24 h. Gels were stained with ethidium bromide and photographed. In vivo transposition reactions were performed as described (Liu and Chalmers, 2014). The reporter strain [E. coli RC5096, F- fhuA2 Δ(lacZ)r1 glnV44 e14-(McrA-) trp-31 his-1 rpsL104 xyl-7 mtl-2 metB1 Δ(mcrC-mrr)114::IS10 argE::Hsmar1-lacZ'-kanR] was derived from ER1793 (New England Biolabs).

Targeted transposition experiments were based on a well known 'plasmid-hop' assay eg. (Munoz-Lopez et al., 2008). The transposon donor plasmid was pRC704, which encodes an R6K origin of replication and a mini-Hsmar1 transposon with a kanamycin resistance gene. The small target plasmid was pRC2312, which is essentially a dimer of pBluescript II SK+ with one of the copies of lacZα removed. The large target was pRC2313, which is identical to the small target except that a 4.5 kb fragment of non-specific DNA from the E. coli chromosomal argE-H locus was inserted. Reactions (15 µl) were performed in our standard transposition buffer (25 mM Tris-HCl at pH 8.0, 5% glycerol, 100 mM sodium chloride, 2 mM DTT, 2.5 mM MgCl2) with 9 nM of target plasmid and 13.5 nM pRC1105 to provide a background of non-specific DNA. Reactions were incubated for 20 minutes at 37ºC, initiated by the addition of the transposon donor plasmid (9 nM) and incubated for a further 24 hours. Reactions were brought to 50 µl with NEB Cutsmart buffer, supplemented with 5 units of NheI and 5 units of lambda exonuclease to degrade the non-specific plasmid. Digestion was stopped by adding 15 µl of stop solution (0.5 mg/mL proteinase K, 0.1% SDS, 50 mM EDTA) and incubating at 60ºC for 2 h. DNA was purified using a spin column from the Qiagen PCR Clean-up kit, which was eluted with 30 µl of EB (10 mM Tris-HCl, pH 8.5). 3-10 µl of the reaction was transformed into chemically competent E. coli NEB5α and plated on LB agar plates supplemented with 50 µg/ml kanamycin, 100 µg/ml ampicillin, 40 µg/ml X-gal and 0.1% lactose. Targeting efficiency (%) was calculated by dividing the number of white colonies by the

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

total number of colonies and multiplying by 100. Target plasmids from randomly selected white colonies were purified and the location of the transposon insertion in lacZα was determined by Sanger sequencing using the M13 reverse primer.

RESULTS

Selection of gRNAs and construction of transposase-dCas9 fusions

Since gRNAs do not all bind their targets equally well (Liu et al., 2016) we screened ten candidates for their ability to inhibit transcription of the target lacZ gene. Oligoduplex spacer sequences, encoding candidate gRNAs, were ligated into the CRISPR locus of plasmid pdCas9 (Figure 1A). Subsequent transcription and processing in vivo produces a mature gRNA, which forms a ribonucleoprotein complex with dCas9. The relative locations and orientations of the selected gRNA target-sequences are shown in Figure 1B. *E. coli* BL21 cells were transformed with each dCas9-gRNA expression plasmids separately and spread on X-gal indictor plates to test the ability of the gRNAs to inhibit transcription of *lacZ*. Only spacers 4 and 7 produced completely white colonies (not shown). Because spacer-7 is within the coding sequence of the gene, it was selected for all further experiments. To create a fusion protein capable of targeted transposition, the Hsmar1 transposase gene was added to the 5'- or the 3'- end of the dCas9 gene in pdCas9 (Figure 1A). Two versions of the fusion protein expression vectors were created, one with and one without spacer-7.

The fusion-proteins are active in vivo

To test whether the fusion proteins were still capable of gRNA-mediated transcriptional repression, the four plasmids were transformed into E. coli BL21 and the lacZ activity was measured using the Miller assay (Figure 2A). There was little silencing with dCas9 or either of the fusion proteins in the absence of the gRNA. In the presence of the gRNA the N- and C- terminal

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

dCas9 fusion proteins both repressed lacZ expression effectively. We then used a bacterial transposition assay to test whether the transposase domain retained activity (Figure 2B). We also tested a plasmid in which the dCas9 gene in pdCas9 was substituted with the transposase gene. This provided a positive control in which transposase expression was driven by the same promoter as the fusion proteins. The rate of transposition was highest for the transposase-dCas9 plasmid, which has the transposase fused to the N-terminus of Cas9. This result should be interpreted with caution as Hsmar1 transposition is subject to over-production inhibition (OPI) whereby an increase in the transposase concentration beyond a low level decreases the rate of transposition (Claeys Bouuaert et al., 2013; Tellier and Chalmers, 2018). Since the promoter on pdCas9 is relatively strong, the system will be dominated by OPI. In the presence of the gRNA the rate of transposition for the N- and C-terminal fusion proteins decreased significantly (Figure 2B). If this result is interpreted in terms of the OPI model, it indicates that the gRNA increased the transpositional-potential of the system, which decreased the rate of transposition on account of OPI. Since the dCas9-transposase protein, which has the transposase on the C-terminus of dCas9, had the best transpositional-potential and the best transcriptional repression in the Miller assay, it was selected for all further experiments (Figure 2A, B).

To explore the relationships between the expression level of the fusion protein and its activities, the native Cas9 promoter in pdCas9 was replaced with promoters P4 to P1, which are of progressively lower strength (Tellier and Chalmers, 2018). As expected, transcriptional repression by the fusion protein was highest with the native Cas9 promoter and decreased progressively with promoter strength (Figure 2C). In contrast, the rate of transposition had an inverse relationship to the strength of the promoter, consistent with the expected effects of OPI mentioned above (Claeys Bouuaert et al., 2013).

dCas9-transposase binds transposon ends and the gRNA target

The assembly pathway for the Hsmar1 transpososome and its behavior in an

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

electrophoretic mobility shift assay (EMSA) is illustrated in Figure 3A, B. Binding of the first transposon end to the transposase dimer yields single-end complex 2 (SEC2). Recruitment of a second end yields the paired-ends complex (PEC). This would normally be followed by the first cleavage step of the reaction, except that the binding buffer lacks the catalytic magnesium ion. During electrophoresis, the PEC decays into single-end complex 1 (SEC1) (Claeys Bouuaert et al., 2013). When the purified dCas9-transposase is titrated into the reaction the disappearance of the free transposon ends is accompanied by the appearance of two clear shifted bands plus a third band close to the bottom of the well (Figure 3C). This is broadly similar to the behavior of the wild type transposase except that the complexes are further up the gel owing to the much larger size of the fusion protein. The band that just enters the gel above SEC2 might represent the PEC, which is detected in some experiments with the wild type transposase (Claeys Bouuaert et al., 2013).

To explore the binding ability of the dCas9 moiety of the fusion protein, an EMSAs was performed with an oligoduplex complimentary to the spacer-7 sequence (Figure 3D, E, F). Since this experiment was performed in vitro we used a single-guide RNA (sgRNA) in which the tracrRNA and the gRNA were joined in a single strand. In the absence of the sgRNA, titration of the fusion protein produced a smear with no clear bands (Figure 3D). Presumably, this indicates weak interactions between the protein and the DNA, which dissociate during electrophoresis. When the fusion protein was provided with the sgRNA, two clear complexes were formed (Figure 3E). The stoichiometry of the complexes is unknown but they may correspond to a dimer of the fusion protein bound by either one or two target oligoduplexes. When we added unlabeled competitor DNA to the reaction it had not effect, which indicates that the oligoduplex binding to the fusion protein is specific (Figure 3F).

In vitro transposition with the dCas9-transposase fusion-protein

Since we had demonstrated DNA binding by the respective dCas9 and

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

transposase moieties of the fusion protein we next wanted to examine the intermediates and products of the in vitro transposition reaction. When the wild type transposase is incubated with a supercoiled substrate, excision of the transposon leaves behind the plasmid backbone, which is an end product of the reaction and a convenient measure of the efficiency (Figure 4). After excision, target sites for integration are acquired by a random collision and tracking mechanism (Claeys Bouuaert and Chalmers, 2010). Titration of the reaction with the wild type transposase or dCas9-transposase yielded a very similar range of products (Figure 4). Minor differences were probably owing to the differences in the quality of the purified proteins. However, adding an oligoduplex encoding the target of the sgRNA reduced the amount of protein required for the maximum production of backbone. It also changed the amount and relative proportions of the reaction products. Most noticeable is the accumulation of the relaxed substrate. This is an intermediate of the reaction generated by the first nick at one of the transposon ends (Claeys Bouuaert and Chalmers, 2010; Claeys Bouuaert et al., 2014). The transition between the first nick and the second, which completes cleavage at the transposon end, involves a significant conformational change (Claeys Bouuaert and Chalmers, 2017; Dornan et al., 2015). Since nicking is absolutely dependent on PEC formation (Claeys Bouuaert et al., 2011), the accumulation of the relaxed intermediate shows that the dCas9 moiety of the fusion protein can interact with its oligoduplex target at the same time as the transposase moiety is engage in a transposition reaction. Clearly, this is a prerequisite for successful targeting.

Targeted transposition reactions

To test whether the dCas9-transposase protein could target transposon insertions to a specific site in vitro we used a modification of the mini-transposon hop assay (Munoz-Lopez et al., 2008). In this assay, transposase catalyses the movement of a transposon encoding a kanamycin resistance gene onto a target plasmid, which in this case encodes the lacZα fragment and an ampicillin resistance gene (Figure 5A). The target was derived from a

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

dimer of pBluescript in which one of the two lacZα fragments had been removed. Since the plasmid has two ampicillin genes and two origins, it has no essential regions and can tolerate insertions anywhere. This allows unbiased recovery of integration events. We refer to the modified pBluescript dimer as the small target. We also created a larger target by adding 4.5 kb of DNA from the E. coli arginine biosynthesis operon. In addition to the transposon donor and target plasmids, transposition reactions also contained a decoy plasmid which provides a background level of non-specific DNA. The reactions were assembled and then initiated by the addition of the transposon donor plasmid.

Transposition reactions were performed with the wild type transposase and the dCas9-transposase fusion-protein either without or with sgRNA-7, which is complementary to the lacZα region of the target plasmids. The integration products were transformed into E. coli NEB5α and plated on LB agar plates supplemented with ampicillin, kanamycin and X-gal (Figure 5B, C). Double transformants containing the donor and target plasmids are not recovered because the R6K origin of replication requires the Pir protein. Transposition reactions with the wild type transposase or the dCas9-transposase fusion yielded very few white colonies (Figure 5B). This reflects the fact that the lacZα fragment represents only about 1/650th of the DNA sequences available for integration. In contrast, more than half of the colonies are white when the dCas9-transposase protein is provided with the sgRNA. The targeting efficiency is plotted in Figure 5C where it is defined as the percentage of all colonies that were white.

In the case of the blue colonies, the transformants must have contained plasmids with transposon insertions outside of the *lacZα* region. We therefore focused on the white colonies and used DNA sequencing to determine the transposon integration sites (Figure 5D). In pBluescript the *lacZα* open reading frame (ORF) is engineered to include a polylinker and it is therefore longer than the corresponding region from the wild type lacZ gene. The ORF

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

also codes for additional amino acids at the 3'-end that are not necessary for alpha complementation (Nishiyama et al., 2015). All in all, the target region in pBluescript in which integration events will yield a white phenotype is 315 bp long (Figure 5D). Within this region there are 18 TA dinucleotides, which are required for the integration of mariner transposons. Only eight of these sites are represented amongst the 20 un-targeted integrations mapped for the wild type transposase and the dCas9-transposase fusion without the sgRNA (Figure 5D). This is not unusual as mild integration bias is well documented for the mariner transposons, where preferred sites are known as hot spots (Claeys Bouuaert and Chalmers, 2013; Conte et al., 2019; Crenes et al., 2009).

We next examined the lacZα integration sites targeted by the dCas9-sgRNA-transposase. We found that all had occurred at two TA dinucleotides located 18 to 22 bp to one side of the sgRNA binding site (Figure 5D, E). On the other side of the binding site there are TA dinucleotides between 8 and 18 bp distant that were not used. The location of the integration sites immediately to one side of the binding site probably reflects constraints imposed by the relative orientations of the dCas9 and the transposase domains and the length of the linker region. It will be interesting to test the site-preference of the transposase-dCas9 fusion, in which the positions of the domains are swapped with respect to the N- and C-termini of the protein.

DISCUSSION

The long dwell time of dCas9 at its target site makes it a powerful tool for gene activation and repression (Gilbert et al., 2014). It is also an attractive candidate for transposon targeting. However, one study reported that although piggyBac integrations at a specific target site were enriched by zinc finger and TALE protein-fusions, dCas9 appeared to protect the locus (Luo et al., 2017). In the present work we have demonstrated that a mariner transposon can be effectively targeted by dCas9 and that protection from integration is probably therefore peculiar to piggyBac. We found that the

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

targeted mariner insertions were at two adjacent TA dinucleotides about 20 bp 5' to the sgRNA binding site (Figure 4E). Other TA dinucleotides located between 31 and 34 bp 5', and between 8 and 18 bp 3', of the sgRNA binding sites were not used. This indicates that the integration site is tightly constrained.

The properties of the inter-domainal linker and the intrinsic target-site preference of the transposase may both contribute to the constrained selection of integration sites. Most, if not all, DNA transposon have preferred target hot spots. For example, there is one extremely hot spot for Mos1 integration that attracts almost all events in the Tn9 chloramphenicol acetyl transferase gene (Crenes et al., 2009). Hsmar1 is perhaps less biased but some sites are certainly less preferred than others (Claeys Bouuaert and Chalmers, 2013). To link the dCas9 and Hsmar1 transposase domains we used a sequence of 187 amino acids encoding the E. coli thioredoxin protein. Although this will be less prone to proteolysis than a flexible linker of the same length, the compaction due to elements of secondary and tertiary structure will prevent the transposase domain reaching distant sites. The linker may also constrain the orientation of the transposase domain with respect to dCas9 and its binding site. However, since the two targeted TA dinucleotides are 4 bp apart they will be on almost opposite faces of the DNA helix. This indicates that the angular distribution is not tightly constrained. Nevertheless, it will be interesting to engineer additional TA dinucleotides into the sequence to explore the constraint further. It will also be interesting to use flexible linkers of different lengths.

In targeting experiments with other transposase-fusion proteins the selection of integration sites was not tightly constrained as observed here. Fusing Mos1 or piggyBac transposases to Gal4 using a 22 amino acid linker enriched for integration sites about 900 bp away from the Gal4 upstream activating sequence (UAS). In the case of Mos1, 98% of the integrations were at a TA dinucleotide 954 bp from the binding site (Maragathavally et al., 2006). Such frequent use of a site, almost 10 DNA-persistence-lengths away from the Gal4-UAS, can not be explained by the constraints of the binding moiety.

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

Instead, a combination of factors may be at work. For example, the short dwell time of DNA binding proteins, which range from seconds to minutes, will increase the local concentration of the transpososome, which may then select a nearby hot spot. This scenario may also explain the partial enrichment of AAV Rep-Sleeping Beauty integration at a site 700 bp from the Rep recognition sequence (Ammar et al., 2012). In another report, fusing the piggyBac transposase to zinc finger and TALE proteins with linkers as short as 15 amino acids enriched for integrations between 24 and 5000 bp from the binding site in the hypoxanthine phosphoribosyl transferase (HPRT) gene (Luo et al., 2017; Owens et al., 2013). Within this region, integrations were biased towards the HPRT transcriptional start site. This may be owing to the chromatin configuration or topological changes in the DNA. For example, mariner transposition is sensitive to supercoiling in the transposon donor and the target (Claeys Bouuaert and Chalmers, 2013; Claeys Bouuaert et al., 2011).

In addition to the targeting experiments, we also compared the reaction intermediates with the transposase and the dCas9-transposase proteins (Figure 2, 3). In the EMSA, the nucleoprotein complexes were very similar (Figure 2). Likewise, in reactions with a transposon on a plasmid substrate, the kinetics of the reaction intermediates were similar (Figure 3). However, there was a slight delay between first and second strand cleavage at the transposon end when the target of the sgRNA was included in the reaction. Overall, it is clear that the Hsmar1 transposase behaves normally when fused to dCas9 and that dCas9 is therefore a promising system for targeted integration. The single biggest problem in targeted-transposition protocols is that successful targeting in a particular cell is often accompanied by random integrations. It should be possible to minimize this problem delivering the transpososome to the cells after in vitro assembly (Trubitsyna et al., 2017). However, to overcome random integration events, it will be necessary to control the timing of integration to allow an opportunity for the targeting moiety to find its binding site. This work is currently underway.

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

REFERENCES

Ammar, I., Gogol-Doring, A., Miskey, C., Chen, W., Cathomen, T., Izsvak, Z., and Ivics, Z. (2012). Retargeting transposon insertions by the adeno-associated virus Rep protein. Nucleic acids research *40*, 6693-6712.

Anders, C., Niewoehner, O., and Jinek, M. (2015). In Vitro Reconstitution and Crystallization of Cas9 Endonuclease Bound to a Guide RNA and a DNA Target. Methods in enzymology *558*, 515-537.

Balciunas, D., Wangensteen, K.J., Wilber, A., Bell, J., Geurts, A., Sivasubbu, S., Wang, X., Hackett, P.B., Largaespada, D.A., McIvor, R.S., *et al.* (2006). Harnessing a high cargo-capacity transposon for genetic applications in vertebrates. PLoS genetics *2*, e169.

Bikard, D., Jiang, W., Samai, P., Hochschild, A., Zhang, F., and Marraffini, L.A. (2013). Programmable repression and activation of bacterial gene expression using an engineered CRISPR-Cas system. Nucleic acids research *41*, 7429-7437.

Blundell-Hunter, G., Tellier, M., and Chalmers, R. (2018). Transposase subunit architecture and its relationship to genome size and the rate of transposition in prokaryotes and eukaryotes. Nucleic Acids Research, gky794-gky794.

Branda, C.S., and Dymecki, S.M. (2004). Talking about a revolution: The impact of site-specific recombinases on genetic analyses in mice. Developmental cell *6*, 7-28.

Chandrasegaran, S., and Smith, J. (1999). Chimeric restriction enzymes: what is next? Biological chemistry *380*, 841-848.

Claeys Bouuaert, C., and Chalmers, R. (2010). Transposition of the human Hsmar1 transposon: rate-limiting steps and the importance of the flanking TA dinucleotide in second strand cleavage. Nucleic acids research *38*, 190-202.

Claeys Bouuaert, C., and Chalmers, R. (2013). Hsmar1 Transposition Is Sensitive to the Topology of the Transposon Donor and the Target. PLoS ONE *8*, e53690.

Claeys Bouuaert, C., and Chalmers, R. (2017). A single active site in the mariner transposase cleaves DNA strands of opposite polarity. Nucleic acids research *45*, 11467-11478.

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

Claeys Bouuaert, C., Lipkow, K., Andrews, S.S., Liu, D., and Chalmers, R. (2013). The autoregulation of a eukaryotic DNA transposon. eLife *2*, e00668.

Claeys Bouuaert, C., Liu, D., and Chalmers, R. (2011). A simple topological filter in a eukaryotic transposon as a mechanism to suppress genome instability. Molecular and cellular biology *31*, 317-327.

Claeys Bouuaert, C., Walker, N., Liu, D., and Chalmers, R. (2014). Crosstalk between transposase subunits during cleavage of the mariner transposon. Nucleic acids research *42*, 5799-5808.

Conte, E., Mende, L., Grainge, I., and Colloms, S.D. (2019). A Mini-ISY100 Transposon Delivery System Effective in γ Proteobacteria. Frontiers in microbiology *10*, 280-280.

Crenes, G., Ivo, D., Herisson, J., Dion, S., Renault, S., Bigot, Y., and Petit, A. (2009). The bacterial Tn9 chloramphenicol resistance gene: an attractive DNA segment for Mos1 mariner insertions. Molecular genetics and genomics : MGG *281*, 315-328.

Dawson, A., and Finnegan, D.J. (2003). Excision of the Drosophila mariner transposon Mos1. Comparison with bacterial transposition and V(D)J recombination. Molecular cell *11*, 225-235.

Ding, S., Wu, X., Li, G., Han, M., Zhuang, Y., and Xu, T. (2005). Efficient transposition of the piggyBac (PB) transposon in mammalian cells and mice. Cell *122*, 473-483.

Dornan, J., Grey, H., and Richardson, J.M. (2015). Structural role of the flanking DNA in mariner transposon excision. Nucleic acids research *43*, 2424-2432.

Feng, X., Bednarz, A.L., and Colloms, S.D. (2010). Precise targeted integration by a chimaeric transposase zinc-finger fusion protein. Nucleic acids research *38*, 1204-1216.

Gilbert, L.A., Horlbeck, M.A., Adamson, B., Villalta, J.E., Chen, Y., Whitehead, E.H., Guimaraes, C., Panning, B., Ploegh, H.L., Bassik, M.C.*, et al.* (2014). Genome-Scale CRISPR-Mediated Control of Gene Repression and Activation. Cell *159*, 647-661.

Grabundzija, I., Irgang, M., Mates, L., Belay, E., Matrai, J., Gogol-Doring, A., Kawakami, K., Chen, W., Ruiz, P., Chuah, M.K.*, et al.* (2010). Comparative analysis of transposable element vector systems in

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

human cells. Molecular therapy : the journal of the American Society of Gene Therapy *18*, 1200-1209.

Ivics, Z., Katzer, A., Stuwe, E.E., Fiedler, D., Knespel, S., and Izsvak, Z. (2007). Targeted Sleeping Beauty transposition in human cells. Molecular therapy : the journal of the American Society of Gene Therapy *15*, 1137-1144.

Izsvak, Z., Ivics, Z., and Plasterk, R.H. (2000). Sleeping Beauty, a wide host-range transposon vector for genetic transformation in vertebrates. Journal of molecular biology *302*, 93-102.

Lamberg, A., Nieminen, S., Qiao, M., and Savilahti, H. (2002). Efficient insertion mutagenesis strategy for bacterial genomes involving electroporation of in vitro-assembled DNA transposition complexes of bacteriophage mu. Applied and environmental microbiology *68*, 705-712.

Lampe, D.J., Churchill, M.E., and Robertson, H.M. (1996). A purified mariner transposase is sufficient to mediate transposition in vitro. The EMBO journal *15*, 5470-5479.

Li, K., Wang, G., Andersen, T., Zhou, P., and Pu, W.T. (2014). Optimization of genome engineering approaches with the CRISPR/Cas9 system. PLoS One *9*, e105779.

Liang, Q., Kong, J., Stalker, J., and Bradley, A. (2009). Chromosomal mobilization and reintegration of Sleeping Beauty and PiggyBac transposons. Genesis (New York, NY : 2000) *47*, 404-408.

Lipkow, K., Buisine, N., and Chalmers, R. (2004). Promiscuous target interactions in the mariner transposon Himar1. The Journal of biological chemistry *279*, 48569-48575.

Liu, D., and Chalmers, R. (2014). Hyperactive mariner transposons are created by mutations that disrupt allosterism and increase the rate of transposon end synapsis. Nucleic acids research *42*, 2637-2645.

Liu, X., Homma, A., Sayadi, J., Yang, S., Ohashi, J., and Takumi, T. (2016). Sequence features associated with the cleavage efficiency of CRISPR/Cas9 system. Scientific reports *6*, 19675.

Lohe, A.R., and Hartl, D.L. (1996). Reduced germline mobility of a mariner vector containing exogenous DNA: effect of size or site? Genetics *143*, 1299-1306.

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

Luo, W., Galvan, D.L., Woodard, L.E., Dorset, D., Levy, S., and Wilson, M.H. (2017). Comparative analysis of chimeric ZFP-, TALE- and Cas9-piggyBac transposases for integration into a single locus in human cells. Nucleic acids research *45*, 8411-8422.

Ma, H., Tu, L.C., and Naseri, A. (2016). CRISPR-Cas9 nuclear dynamics and target recognition in living cells. Journal of Cell Biology *214*, 529-537.

Maragathavally, K.J., Kaminski, J.M., and Coates, C.J. (2006). Chimeric Mos1 and piggyBac transposases result in site-directed integration. FASEB journal : official publication of the Federation of American Societies for Experimental Biology *20*, 1880-1882.

Mates, L., Chuah, M.K., Belay, E., Jerchow, B., Manoj, N., Acosta-Sanchez, A., Grzela, D.P., Schmitt, A., Becker, K., Matrai, J.*, et al.* (2009). Molecular evolution of a novel hyperactive Sleeping Beauty transposase enables robust stable gene transfer in vertebrates. Nature genetics *41*, 753-761.

Miller, J. (1972). Experiments in Molecular Genetics. Cold Spring Harbor Laboratory.

Miskey, C., Papp, B., Mates, L., Sinzelle, L., Keller, H., Izsvak, Z., and Ivics, Z. (2007). The ancient mariner sails again: transposition of the human Hsmar1 element by a reconstructed transposase and activities of the SETMAR protein on transposon ends. Molecular and cellular biology *27*, 4589-4600.

Mitra, R., Fain-Thornton, J., and Craig, N.L. (2008). piggyBac can bypass DNA synthesis during cut and paste transposition. The EMBO journal *27*, 1097-1109.

Munoz-Lopez, M., Siddique, A., Bischerour, J., Lorite, P., Chalmers, R., and Palomeque, T. (2008). Transposition of Mboumar-9: identification of a new naturally active mariner-family transposon. Journal of molecular biology *382*, 567-572.

Nishiyama, K., Ichihashi, N., Kazuta, Y., and Yomo, T. (2015). Development of a reporter peptide that catalytically produces a fluorescent signal through alpha-complementation. Protein science : a publication of the Protein Society *24*, 599-603.

Owens, J.B., Mauro, D., Stoytchev, I., Bhakta, M.S., Kim, M.S., Segal, D.J., and Moisyadi, S. (2013). Transcription activator like effector

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

(TALE)-directed piggyBac transposition in human cells. Nucleic acids research *41*, 9197-9207.

Robertson, H.M., and Zumpano, K.L. (1997). Molecular evolution of an ancient mariner transposon, Hsmar1, in the human genome. Gene *205*, 203-217.

Song, A.J., and Palmiter, R.D. (2018). Detecting and Avoiding Problems When Using the Cre-lox System. Trends in genetics : TIG *34*, 333-340.

Tellier, M., and Chalmers, R. (2018). Development of a papillation assay using constitutive promoters to find hyperactive transposases. bioRxiv, 423012.

Trubitsyna, M., Grey, H., Houston, D.R., Finnegan, D.J., and Richardson, J.M. (2015). Structural Basis for the Inverted Repeat Preferences of mariner Transposases. The Journal of biological chemistry *290*, 13531-13540.

Trubitsyna, M., Michlewski, G., Finnegan, D.J., Elfick, A., Rosser, S.J., Richardson, J.M., and French, C.E. (2017). Use of mariner transposases for one-step delivery and integration of DNA in prokaryotes and eukaryotes by transfection. Nucleic acids research *45*, e89.

Urnov, F.D., Miller, J.C., Lee, Y.L., Beausejour, C.M., Rock, J.M., Augustus, S., Jamieson, A.C., Porteus, M.H., Gregory, P.D., and Holmes, M.C. (2005). Highly efficient endogenous human gene correction using designed zinc-finger nucleases. Nature *435*, 646-651.

Way, J.C., Davis, M.A., Morisato, D., Roberts, D.E., and Kleckner, N. (1984). New Tn10 derivatives for transposon mutagenesis and for construction of lacZ operon fusions by transposition. Gene *32*, 369-379.

Yant, S.R., Huang, Y., Akache, B., and Kay, M.A. (2007). Site-directed transposon integration in human cells. Nucleic acids research *35*, e50.

Zhang, F., Cong, L., Lodato, S., Kosuri, S., Church, G.M., and Arlotta, P. (2011). Efficient construction of sequence-specific TAL effectors for modulating mammalian transcription. Nature Biotechnology *29*, 149.

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

FIGURE LEGENDS

Figure 1 Plasmid pdCas9 and the chromosomal *lacZ* target

A) Plasmid pdCas9 (Bikard et al., 2013) encodes a catalytically inactive Cas9 variant (dCas9) in which the nuclease activity is abolished by the D10A and H840A mutations. Expression is driven by the strong native Cas9 promoter from Streptococcus pyogenes. The spacer is the user-defined sequence that base pairs with the target site.

B) The target site for dCas9 binding was the *E. coli lacZ* gene. Ten candidate spacers were selected to target the promoter and early open reading frame of *lacZ.* Of these 10 candidates, only spacers 4 and 7 inhibited transcription completely, as judged by a white colony on X-gal indicator plates.

Figure 2. Fusion-protein activity in vivo

The Hsmar1 transposase gene was added to the 5'- or the 3'- end of the dCas9 gene in pdCas9, which is illustrated in Figure 1A.

A, The plasmids were transformed into E. coli BL21 and lacZ activity was measured using the Miller assay (Miller, 1972). The lacZ- control was provided by E. coli NEB5α, while LacZ+ is the activity with the untransformed BL21 host. Proteins were expressed from plasmids: dCas9, pdCas9 = pRC2301; transposase-dCas9, pRC2302; transposase-dCas9-gRNA, pRC2304; dCas9-transposase, pRC2303; dCas9-gRNA-transposase, pRC2305.

B, The relative rates of transposition supported by the N- and C-terminal fusions was assayed in E. coli as described previously (Liu and Chalmers, 2014). The wild type transposase was expressed from pRC2306, which is identical to pdCas9 except that the dCas9 gene is replaced by the transposase gene. Other protein expression vectors were as in part B.

C, The relationship between lacZ repression and the fusion-protein expression level was explored. The highest level of expression was with the native Cas9 promoter form pdCas9. Promoters P4 to P1 were progressively weaker (Tellier and Chalmers, 2018). The expression vectors were: P1,

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

pRC2311; P2, pRC2307; P3, pRC2308; P4, pRC2309.

D, The relationship between the expression level and the rate of transposition was explored. Owing to auto-inhibition (or OPI) the highest rate of transposition was with the lowest expression level, as expected (Claeys Bouuaert et al., 2013). Protein expression vectors were as in previous parts.

Figure 3 EMSA analysis of the dCas9-transposase fusion protein

A, Illustration of protein-DNA complexes formed during the transposition reaction and decomposition of the paired-end complex (PEC) during electrophoresis.

B, EMSA of purified Hsmar1 transposase on a TBE buffered 7% polyacrylamide gel. Reactions contained 10 nM of a 70 bp Cy5-labelled oligoduplex encoding a transposon-end substrate. Bands were visualized on a GE Typhoon Fluorimager.

C, EMSA as in part B but with the indicated amounts of the dCas9-transposase fusion protein without sgRNA. The band marked ?, just below the wells, might represent the PEC, which is detected with the wild type transposase if the PEC is artificially stabilized (Claeys Bouuaert et al., 2013).

D, **E** and **F**, the EMSAs were as in part B but with the purified dCas9-transposase fusion protein with its sgRNA. Reactions contained 10 nM of a 70 bp Cy5-labelled oligoduplex complementary to sgRNA-7. When present, the sgRNA was preassembled in a 1:1.5 molar excess to the protein prior to the EMSA. The non-specific competitor plasmid was 1 μg of pRC2301 per binding reaction.

Figure 4 *In vitro* transposition assays with the dCas9-transposase

Transposition reactions were 50 μl with 6.5 nM of supercoiled plasmid substrate (pRC650). The reactions were initiated by adding transposase and incubated for 4 h at 37^{o}C. Reactions were deproteinated with proteinase K and SDS and 20 μl was electrophoresed on a TBE buffered 1.1% agarose gel at 60 V overnight. Photographs of ethidium bromide stained gels are shown. When present, the sgRNA was preassembled in a 1:1.5 molar excess to the

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

protein prior to the reaction. Where indicated, reactions contained 10 nM of a 70 bp oligoduplex complementary to the sgRNA.

Figure 5 Transposon targeting reactions

A, Illustration of the transposon donor and target plasmids. The donor plasmid (pRC704) encodes and Hsmar1 transposon with an R6K origin of recognition and a kanamycin resistance gene. The target plasmid (pRC2312) is essentially a dimer of pBluescript with one copy of the lacZα gene removed. Since the plasmid has two origins and to ampicillin markers it can tolerate transposon insertions anywhere. The large target has an extra 4.5 kb of DNA non-specific DNA. Reactions also contained a background of non-specific DNA.

B, Reactions were performed with the indicated transposase proteins, transformed into E. coli and plated on LB plus ampicillin, kanamycin and X-gal. Transposon integrations into the lacZα gene yield white colonies. Integrations elsewhere yield blue colonies.

C, Targeting efficiency. Error-bars are standard error of the mean where n = 6 biological replicates. Ordinary one-way ANOVA analysis: Small target; transposase vs. dCas9-transposase, P = 0.95; transposase vs. dCas9-sgRNA-transposase, P = <0.0001; dCas9-transposase vs. dCas9-sgRNA-transposase, P = <0.0001. Large target: transposase vs. dCas9-transposase, P = 0.14; transposase vs. dCas9-sgRNA-transposase, P = <0.0001; dCas9-transposase vs. dCas9-sgRNA-transposase, P = <0.0001.

D, Ten white colonies were picked from the three sets of plates and the location of the transposon insertion determined by Sanger sequencing.

E, An expanded view of the indicated area of the lacZα gene.

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

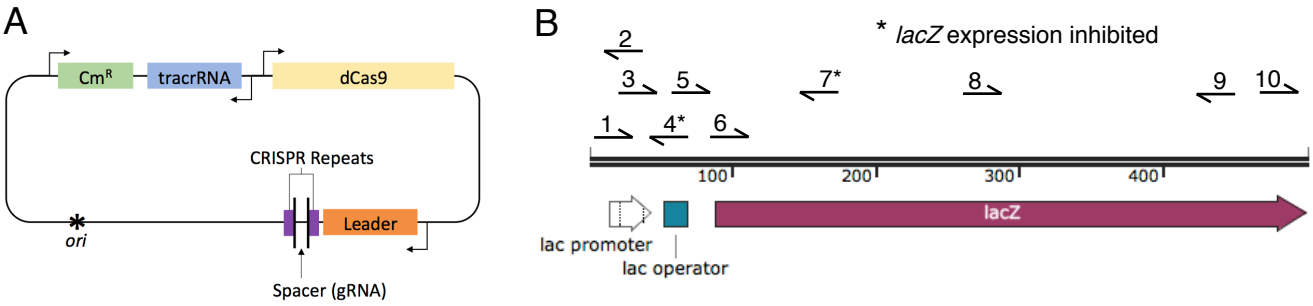


Figure 1

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

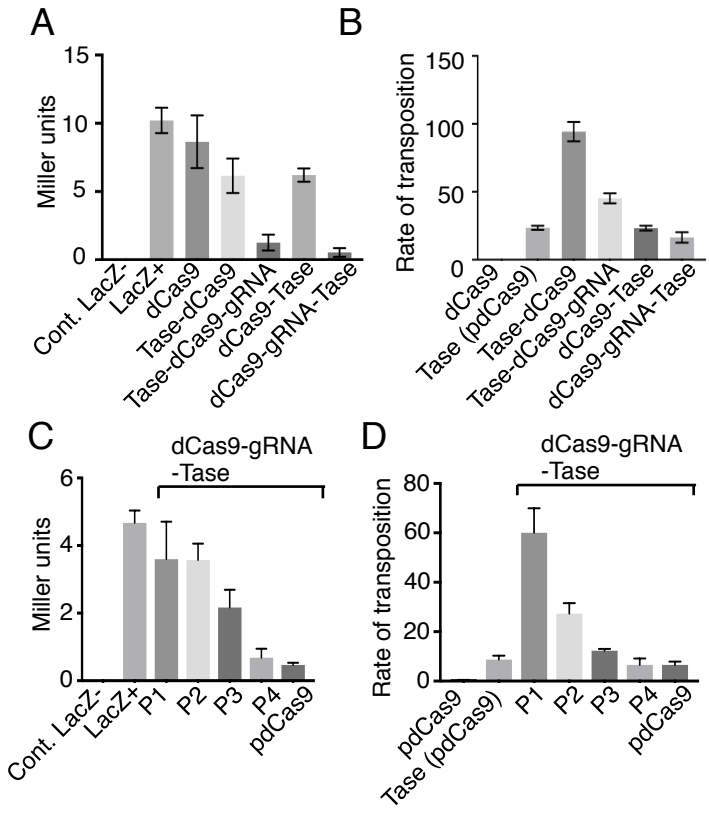


Figure 2

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

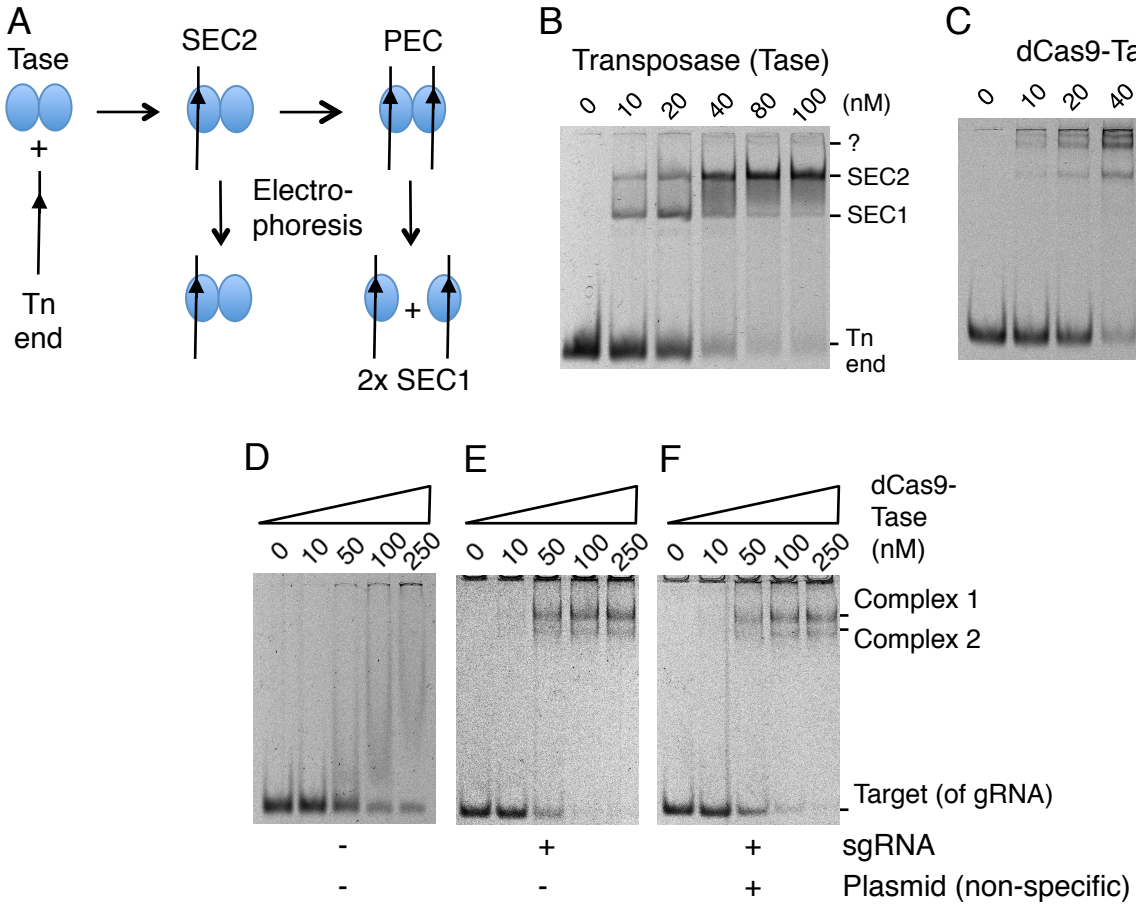


Figure 3

bioRxiv preprint doi: https://doi.org/10.1101/571653; this version posted April 12, 2019. The copyright holder for this preprint (which was not certified by peer review) is the author/funder. All rights reserved. No reuse allowed without permission.

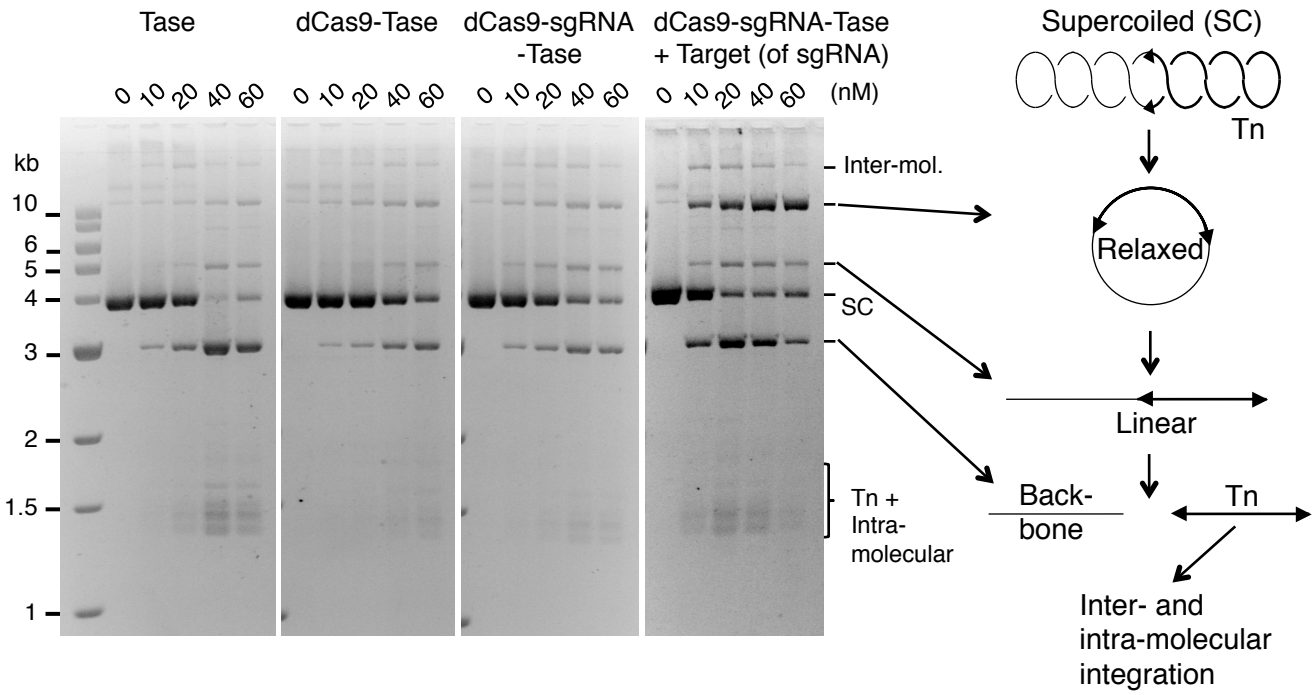


Figure 4

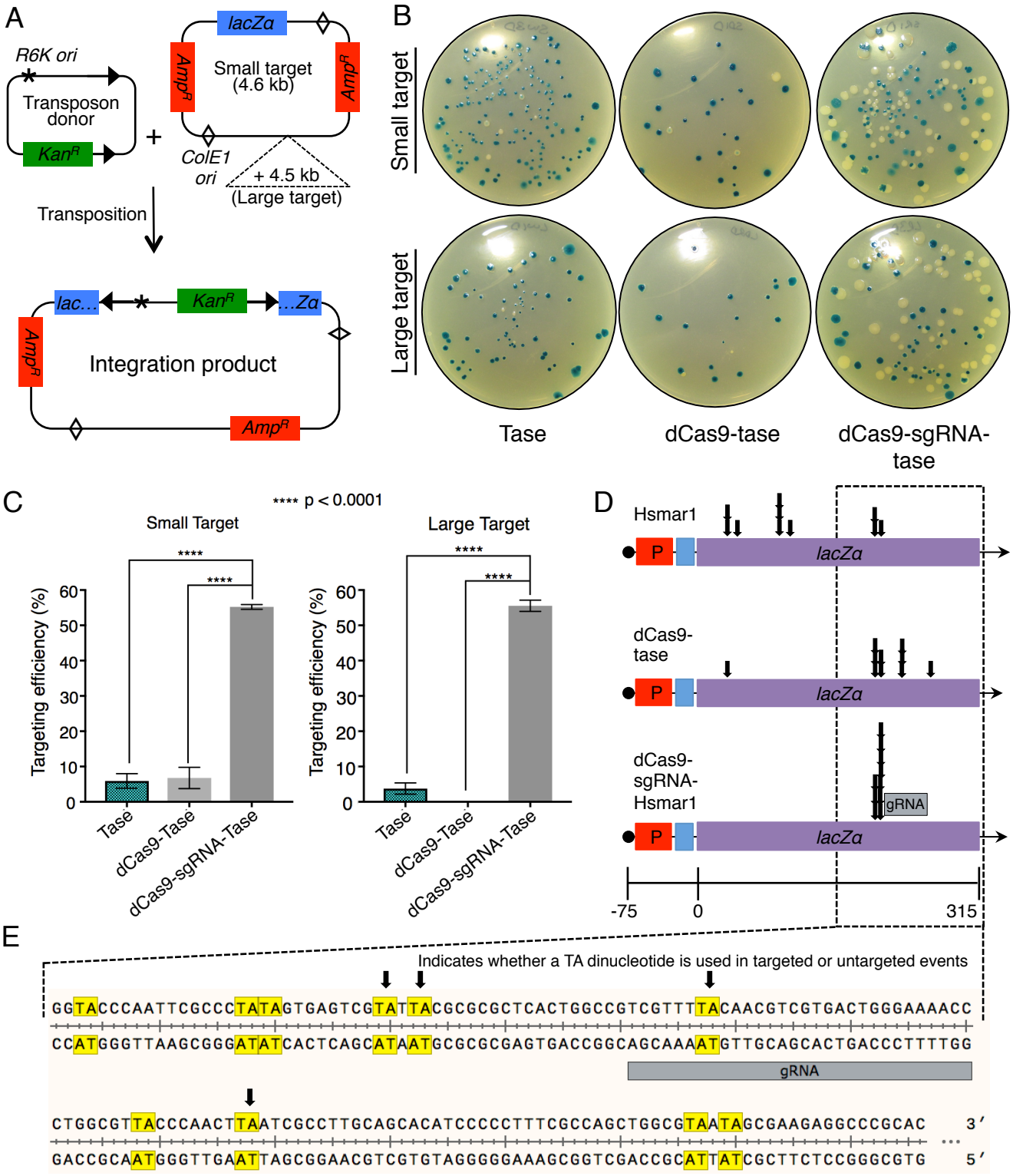
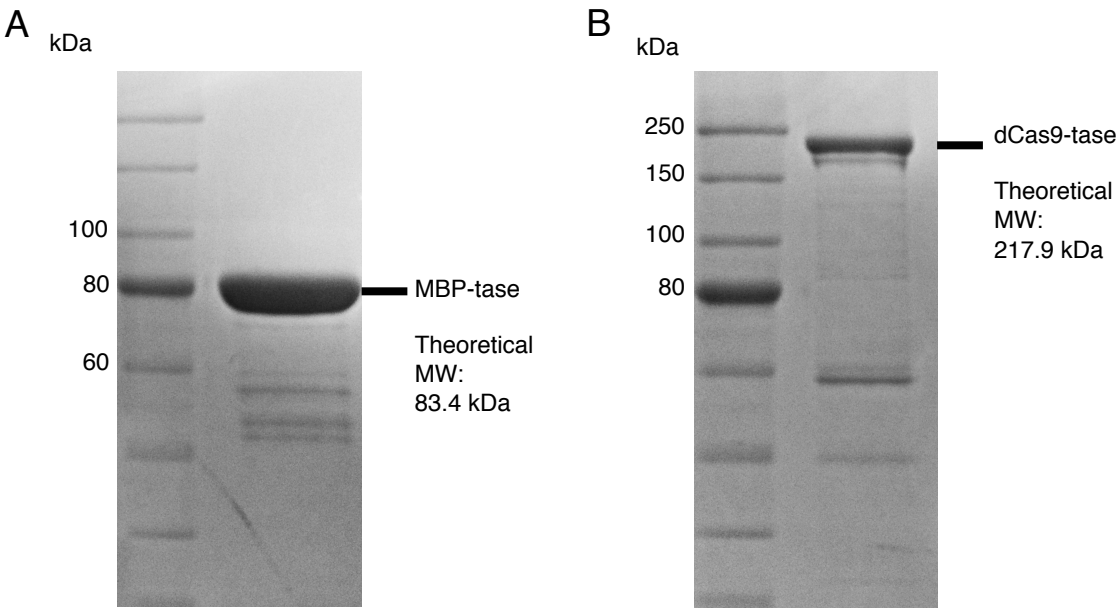

A
R6K ori
Transposon donor
Kan^R
+
lacZα
Amp^R
Small target (4.6 kb)
Amp^R
ColE1 ori
+ 4.5 kb
(Large target)
Transposition
lac...
Kan^R
...Zα
Amp^R
Integration product
Amp^R
B
Small target
Large target
Tase
dCas9-tase
dCas9-sgRNA-tase
C
**** p < 0.0001
Small Target
Large Target
Targeting efficiency (%)
Tase
dCas9-Tase
dCas9-sgRNA-Tase
D
Hsmar1
P
lacZα
dCas9-tase
dCas9-sgRNA-Hsmar1
gRNA
-75
0
315
E
Indicates whether a TA dinucleotide is used in targeted or untargeted events
GGTACCCAATTCGCCCTATAGTGAGTCGTATTACGCGCGCTCACTGGCCGTCGTTTTACAACGTCGTGACTGGGAAAACC
CCATGGGTTAAGCGGGATATCACTCAGCATAATGCGCGCGAGTGACCGGCAGCAAAATGTTGCAGCACTGACCCTTTTGG
gRNA
CTGGCGTTACCCAACTTAATCGCCTTGCAGCACATCCCCCTTTCGCCAGCTGGCGTAATAGCGAAGAGGCCCGCAC 3′
GACCGCAATGGGTTGAATTAGCGGAACGTCGTGTAGGGGGAAAGCGGTCGACCGCATTATCGCTTCTCCGGGCGTG 5′

Figure 5



Supplemental Figure 1 Purification of Hsmar1 transposase and dCas9 transposase.

Supplemental Table 1 Plasmid Sequences

pRC704

AATTCTATTAGGTTGGTGCAAAAGTAATTGCGGTTTTGGATCCGGCTGTAATCCG
GGCAGCGCAACGGAACATTCATCAGTGTAAAAATGGAATCAATAAAGCCCTGCG
CAGCGCGCAGGGTCAGCCTGAATACGCGTTTAATGACCAGCACAGTCGTGATG
GCAAGGTCAGAATAGCGCTGAGGTCTGCCTCGTGAAGAAGGTGTTGCTGACTC
ATACCAGGCCTGAATCGCCCCATCATCCAGCCAGAAAGTGAGGGAGCCACGGT
TGATGAGAGCTTTGTTGTAGGTGGACCAGTTGGTGATTTTGAACTTTTGCTTTGC
CACGGAACGGTCTGCGTTGTCGGGAAGATGCGTGATCTGATCCTTCAACTCAGC
AAAAGTTCGATTTATTCAACAAAGCCACGTTGTGTCTCAAAATCTCTGATGTTAC
ATTGCACAAGATAAAAATATATCATCATGAACAATAAAACTGTCTGCTTACATAAA
CAGTAATACAAGGGGTGTTATGAGCCATATTCAACGGGAAACGTCTTGCTCGAG
GCCGCGATTAAATTCCAACATGGATGCTGATTTATATGGGTATAAATGGGCTCG
CGATAATGTCGGGCAATCAGGTGCGACAATCTATCGATTGTATGGGAAGCCCGA
TGCGCCAGAGTTGTTTCTGAAACATGGCAAAGGTAGCGTTGCCAATGATGTTAC
AGATGAGATGGTCAGACTAAACTGGCTGACGGAATTTATGCCTCTTCCGACCAT
CAAGCATTTTATCCGTACTCCTGATGATGCATGGTTACTCACCACTGCGATCCCC
GGGAAAACAGCATTCCAGGTATTAGAAGAATATCCTGATTCAGGTGAAAATATTG
TTGATGCGCTGGCAGTGTTCCTGCGCCGGTTGCATTCGATTCCTGTTTGTAATT
GTCCTTTTAACAGCGATCGCGTATTTCGTCTCGCTCAGGCGCAATCACGAATGA
ATAACGGTTTGGTTGATGCGAGTGATTTTGATGACGAGCGTAATGGCTGGCCTG
TTGAACAAGTCTGGAAAGAAATGCATAAGCTTTTGCCATTCTCACCGGATTCAGT
CGTCACTCATGGTGATTTCTCACTTGATAACCTTATTTTTGACGAGGGGAAATTA
ATAGGTTGTATTGATGTTGGACGAGTCGGAATCGCAGACCGATACCAGGATCTT
GCCATCCTATGGAACTGCCTCGGTGAGTTTTCTCCTTCATTACAGAAACGGCTTT
TTCAAAAATATGGTATTGATAATCCTGATATGAATAAATTGCAGTTTCATTTGATG
CTCGATGAGTTTTTCTAATCAGAATTGGTTAATTGGTTGTAACACTGGCAGAGCA
TTACGCTGACTTGACGGGACGGCGGCTTTGTTGAATAAATCGAACTTTTGCTGA
GTTGAAGGATCAGATCACGCATCTTCCCGACAACGCAGACCGTTCCGTGGCAAA
GCAAAAGTTCAAAATCACCAACTGGTCCACCTACAACAAAGCTCTCATCAACCG
TGGCTCCCTCACTTTCTGGCTGGATGATGGGGCGATTCAGGCCTGGTATGAGTC
AGCAACACCTTCTTCACGAGGCAGACCTCAGCGCTATTCTGACCTTGCCATCAC
GACTGTGCTGGTCATTAAACGCGTATTCAGGCTGACCCTGCGCGCTGCGCAGG
GCTTTATTGATTCCATTTTTACACTGATGAATGTTCCGTTGCGCTGCCCGGATTA
CAGCCGGATCCGGCCACGATGCGTCCGGCGTAGAGGATCTGAAGATCAGCAGT
TCAACCTGTTGATAGTACGTACTAAGCTCTCATGTTTCACGTACTAAGCTCTCAT
GTTTAACGTACTAAGCTCTCATGTTTAACGAACTAAACCCTCATGGCTAACGTAC
TAAGCTCTCATGGCTAACGTACTAAGCTCTCATGTTTCACGTACTAAGCTCTCAT
GTTTGAACAATAAAATTAATATAAATCAGCAACTTAAATAGCCTCTAAGGTTTTAA
GTTTTATAAGAAAAAAAAGAATATATAAGGCTTTTAAAGCTTTTAAGGTTTAACGG
TTGTGGACAACAAGCCAGGGATGTAACGCACTGAGAAGCCCTTAGAGCCTCTCA
AAGCAATTTTGAGTGACACAGGAACACTTAACGGCTGACATGGGAATTCCACAT

GTGGAATTCCACATGTGGAATTGTGAGCGGATAACAATTTGTGGAATTCCCGGG
AGAGCTCGATATCGCATGCGGTACCTCTAGAAGAAGCTTGGGATCCAAAACCGC
AATTACTTTTGCACCAACCTAATAGAATTCTGGCGTAATAGCGAAGAGGCCCGC
ACCGATCGCCCTTCCCAACAGTTGCGCAGCCTGAATGGCGAATGGGACGCGCC
CTGTAGCGGCGCATTAAGCGCGGCGGGTGTGGTGGTTACGCGCAGCGTGACC
GCTACACTTGCCAGCGCCCTAGCGCCCGCTCCTTTCGCTTTCTTCCCTTCCTTT
CTCGCCACGTTCGCCGGCTTTCCCCGTCAAGCTCTAAATCGGGGGCTCCCTTTA
GGGTTCCGATTTAGTGCTTTACGGCACCTCGACCCCAAAAAACTTGATTAGGGT
GATGGTTCACGTAGTGGGCCATCGCCCTGATAGACGGTTTTTCGCCCTTTGACG
TTGGAGTCCACGTTCTTTAATAGTGGACTCTTGTTCCAAACTGGAACAACACTCA
ACCCTATCTCGGTCTATTCTTTTGATTTATAAGGGATTTTGCCGATTTCGGCCTAT
TGGTTAAAAAATGAGCTGATTTAACAAAAATTTAACGCGAATTTTAACAAAATATT
AACGCTTACAATTTAGGTGGCACTTTTCGGGGAAATGTGCGCGGAACCCCTATT
TGTTTATTTTTCTAAATACATTCAAATATGTATCCGCTCATGAGACAATAACCCTG
ATAAATGCTTCAATAATATTGAAAAAGGAAGAGTATGAGTATTCAACATTTCCGT
GTCGCCCTTATTCCCTTTTTTGCGGCATTTTGCCTTCCTGTTTTTGCTCACCCAG
AAACGCTGGTGAAAGTAAAAGATGCTGAAGATCAGTTGGGTGCACGAGTGGGTT
ACATCGAACTGGATCTCAACAGCGGTAAGATCCTTGAGAGTTTTCGCCCCGAAG
AACGAGCGGAAGAGCGCCCAATACGCAAACCGCCTCTCCCCGCGCGTTGGCCG
ATTCATTAATGCAG

pRC1104

TTCAGTTTAGCCTTAACCGGCGCATGACTTCAAGACTAACTCCTCTAAATCAATT
ACCAGTGGCTGCTGCCAGTGGTGCTTTTGCATGTCTTTCCGGGTTGGACTCAAG
ACGATAGTTACCGGATAAGGCGCAGCGGTCGGACTGAACGGGGGGTTCGTGCA
TACAGTCCAGCTTGGAGCGAACTGCCTACCCGGAACTGAGTGTCAGGCGTGGA
ATGAGACAAACGCGGCCATAACAGCGGAATGACACCGGTAAACCGAAAGGCAG
GAACAGGAGAGCGCACGAGGGAGCCGCCAGGGGGAAACGCCTGGTATCTTTAT
AGTCCTGTCGGGTTTCGCCACCACTGATTTGAGCGTCAGATTTCGTGATGCTTG
TCAGGGGGGCGGAGCCTATGGAAAAACGGCTTTGCCGCGGCCCTCTCACTTCC
CTGTTAAGTATCTTCCTGGCATCTTCCAGGAAATCTCCGCCCCGTTCGTAAGCC
ATTTCCGCTCGCCGCAGTCGAACGACCGAGCGTAGCGAGTCAGTGAGCGAGGA
AGCGGAATATATCCTGTATCACATATTCTGCTGACGCACCGGTGCAGCCTTTTTT
CTCCTGCCACATGAAGCACTTCACTGACACCCTCATCAGTGCCAACATAGTAAG
CCAGTATACACTCCGCTAGCGCTGATGTCCGGCGGTGCTTTTGCCGTTACGCAC
CACCCCGTCAGTAGCTGAACAGGAGGGACAGCTGATAGAAACAGAAGCCACTG
GAGCACCTCAAAAACACCATCATACACTAAATCAGTAAGTTGGCAGCATCACCC
GACGCACTTTGCGCCGAATAAATACCTGTGACGGAAGATCACTTCGCAGAATAA
ATAAATCCTGGTGTCCCTGTTGATACCGGGAAGCCCTGGGCCAACTTTTGGCGA
AAATGAGACGTTGATCGGCACGTAAGAGGTTCCAACTTTCACCATAATGAAATAA
GATCACTACCGGGCGTATTTTTTGAGTTATCGAGATTTTCAGGAGCTAAGGAAG
CTAAAATGGAGAAAAAAATCACTGGATATACCACCGTTGATATATCCCAATGGCA
TCGTAAAGAACATTTTGAGGCATTTCAGTCAGTTGCTCAATGTACCTATAACCAG

ACCGTTCAGCTGGATATTACGGCCTTTTTAAAGACCGTAAAGAAAAATAAGCACA
AGTTTTATCCGGCCTTTATTCACATTCTTGCCCGCCTGATGAATGCTCATCCGGA
ATTCCGTATGGCAATGAAAGACGGTGAGCTGGTGATATGGGATAGTGTTCACCC
TTGTTACACCGTTTTCCATGAGCAAACTGAAACGTTTTCATCGCTCTGGAGTGAA
TACCACGACGATTTCCGGCAGTTTCTACACATATATTCGCAAGATGTGGCGTGTT
ACGGTGAAAACCTGGCCTATTTCCCTAAAGGGTTTATTGAGAATATGTTTTTCGT
CTCAGCgAATCCCTGGGTGAGTTTCACCAGTTTTGATTTAAACGTGGCCAATATG
GACAACTTCTTCGCCCCCGTTTTCACCATGGGCAAATATTATACGCAAGGCGAC
AAGGTGCTGATGCCGCTGGCGATTCAGGTTCATCATGCCGTCTGTGATGGCTTC
CATGTCGGCAGAATGCTTAATGAATTACAACAGTACTGCGATGAGTGGCAGGGC
GGGGCGTAATTTTTTTAAGGCAGTTATTGGTGCCCTTAAACGCCTGGTGCTACG
CCTGAATAAGTGATAATAAGCGGATGAATGGCAGAAATTCGAAAGCAAATTCGA
CCCGGTCGTCGGTTCAGGGCAGGGTCGTTAAATAGCCGCTTATGTCTATTGCTG
GTTTACCGGTTTATTGACTACCGGAAGCAGTGTGACCGTGTGCTTCTCAAATGC
CTGAGGCCAGTTTGCTCAGGCTCTCCCCGTGGAGGTAATAATTGACGATATGAT
CATTTATTCTGCCTCCCAGAGCCTGATAAAAACGGTTAGCGCTTCGTTAATACAG
ATGTAGGTGTTCCACAGGGTAGCCAGCAGCATCCTGCGATGCAGATCCGGAAC
ATAATGGTGCAGGGCGCTTGTTTCGGCGTGGGTATGGTGGCAGGCCCCGTGGC
CGGGGGACTGTTGGGCGCTGCCGGCACCTGTCCTACGAGTTGCATGATAAAGA
AGACAGTCATAAGTGCGGCGACGATAGTCATGCCCCGCGCCCACCGGAAGGAG
CTACCGGACAGCGGTGCGGACTGTTGTAACTCAGAATAAGAAATGAGGCCGCT
CATGGCGTTGACTCTCAGTCATAGTATCGTGGTATCACCGGTTGGTTCCACTCT
CTGTTGCGGGCAACTTCAGCAGCACGTAGGGGACTTCCGCGTTTCCAGACTTTA
CGAAACACGGAAACCGAAGACCATTCATGTTGTTGCTCAGGTCGCAGACGTTTT
GCAGCAGCAGTCGCTTCACGTTCGCTCGCGTATCGGTGATTCATTCTGCTAACC
AGTAAGGCAACCCCGCCAGCCTAGCCGGGTCCTCAACGACAGGAGCACGATCA
TGCGCACCCGTGGCCAGGACCCAACGCTGCCCGAGATGCGCCGCGTGCGGCT
GCTGGAGATGGCGGACGCGATGGATATGTTCTGCCAAGGGTTGGTTTGCGCAT
TCACAGTTCTCCGCAAGAATTGATTGGCTCCAATTCTTGGAGTGGTGAATCCGTT
AGCGAGGTGCCGCCGGCTTCCATTCAGGTCGAGGTGGCCCGGCTCCATGCACC
GCGACGCAACGCGGGGAGGCAGACAAGGTATAGGGCGGCGCCTACAATCCAT
GCCAACCCGTTCCATGTGCTCGCCGAGGCGGCATAAATCGCCGTGACGATCAG
CGGTCCAGTGATCGAAGTTAGGCTGGTAAGAGCCGCGAGCGATCCTTGAAGCT
GTCCCTGATGGTCGTCATCTACCTGCCTGGACAGCATGGCCTGCAACGCGGGC
ATCCCGATGCCGCCGGAAGCGAGAAGAATCATAATGGGGAAGGCCATCCAGCC
TCGCGTCGCGAACGCCAGCAAGACGTAGCCCAGCGCGTCGGCCGCCATGCCG
GCGATAATGGCCTGCTTCTCGCCGAAACGTTTGGTGGCGGGACCAGTGACGAA
GGCTTGAGCGAGGGCGTGCAAGATTCCGAATACCGCAAGCGACAGGCCGATCA
TCGTCGCGCTCCAGCGAAAGCGGTCCTCGCCGAAAATGACCCAGAGCGCTGCC
GGCACCTGTCCTACGAGTTGCATGATAAAGAAGACAGTCATAAGTGCGGCGAC
GATAGTCATGCCCCGCGCCCACCGGAAGGAGCTGACTGGGTTGAAGGCTCTCA
AGGGCATCGGTCGACGCTCTCCCTTATGCGACTCCTGCATTAGGAAGCAGCCC
AGTAGTAGGTTGAGGCCGTTGAGCACCGCCGCCGCAAGGAATGGTGCATGCAA
GGAGATGGCGCCCAACAGTCCCCCGGCCACGGGGCCTGCCACCATACCCACG

CCGAAACAAGCGCTCATGAGCCCGAAGTGGCGAGCCCGATCTTCCCCATCGGT
GATGTCGGCGATATAGGCGCCAGCAACCGCACCTGTGGCGCCGGTGATGCCG
GCCACGATGCGTCCGGCGTAGAGGATCCACAGGACGGGTGTGGTCGCCATGAT
CGCGTAGTCGATAGTGGCTCCAAGTAGCGAAGCGAGCAGGACTGGGCGGCGG
CCAAAGCGGTCGGACAGTGCTCCGAGAACGGGTGCGCATAGAAATTGCATCAA
CGCATATAGCGCTAGCAGCACGCCATAGTGACTGGCGATGCTGTCGGAATGGA
CGATATCCCGCAAGAGGCCCGGCAGTACCGGCATAACCAAGCCTATGCCTACA
GCATCCAGGGTGACGGTGCCGAGGATGACGATGAGCGCATTGTTAGATTTCATA
CACGGTGCCTGACTGCGTTAGCAATTTAACTGTGATAAACTACCGCATTAAAGCT
TATCGATGATAAGCTGTCAAACATGAGAATTACAACTTATATCGTATGGGGCTGA
CTTCAGGTGCTACATTTGAAGAGATAAATTGCACTGAAATCTAGAAATATTTTATC
TGATTAATAAGATGATCTTCTTGAGATCGTTTTGGTCTGCGCGTAATCTCTTGCT
CTGAAAACGAAAAAACCGCCTTGCAGGGCGGTTTTTCGAAGGTTCTCTGAGCTA
CCAACTCTTTGAACCGAGGTAACTGGCTTGGAGGAGCGCAGTCACCAAAACTTG
TCCTTTCAGTTTAGCCTTAACCGGCGCATGACTTCAAGACTAACTCCTCTAAATC
AATTACCAGTGGCTGCTGCCAGTGGTGCTTTTGCATGTCTTTCCGGGTTGGACT
CAAGACGATAGTTACCGGATAAGGCGCAGCGGTCGGACTGAACGGGGGGTTCG
TGCATACAGTCCAGCTTGGAGCGAACTGCCTACCCGGAACTGAGTGTCAGGCG
TGGAATGAGACAAACGCGGCCATAACAGCGGAATGACACCGGTAAACCGAAAG
GCAGGAACAGGAGAGCGCACGAGGGAGCCGCCAGGGGGAAACGCCTGGTATC
TTTATAGTCCTGTCGGGTTTCGCCACCACTGATTTGAGCGTCAGATTTCGTGATG
CTTGTCAGGGGGGCGGAGCCTATGGAAAAACGGCTTTGCCGCGGCCCTCTCAC
TTCCCTGTTAAGTATCTTCCTGGCATCTTCCAGGAAATCTCCGCCCCGTTCGTAA
GCCATTTCCGCTCGCCGCAGTCGAACGACCGAGCGTAGCGAGTCAGTGAGCGA
GGAAGCGGAATATATCCTGTATCACATATTCTGCTGACGCACCGGTGCAGCCTT
TTTTCTCCTGCCACATGAAGCACTTCACTGACACCCTCATCAGTGCCAACATAGT
AAGCCAGTATACACTCCGCTAGCGCTGATGTCCGGCGGTGCTTTTGCCGTTACG
CACCACCCCGTCAGTAGCTGAACAGGAGGGACAGCTGATAGAAACAGAAGCCA
CTGGAGCACCTCAAAAACACCATCATACACTAAATCAGTAAGTTGGCAGCATCA
CCCGACGCACTTTGCGCCGAATAAATACCTGTGACGGAAGATCACTTCGCAGAA
TAAATAAATCCTGGTGTCCCTGTTGATACCGGGAAGCCCTGGGCCAACTTTTGG
CGAAAATGAGACGTTGATCGGCACGTAAGAGGTTCCAACTTTCACCATAATGAA
ATAAGATCACTACCGGGCGTATTTTTTGAGTTATCGAGATTTTCAGGAGCTAAGG
AAGCTAAAATGGAGAAAAAAATCACTGGATATACCACCGTTGATATATCCCAATG
GCATCGTAAAGAACATTTTGAGGCATTTCAGTCAGTTGCTCAATGTACCTATAAC
CAGACCGTTCAGCTGGATATTACGGCCTTTTTAAAGACCGTAAAGAAAAATAAG
CACAAGTTTTATCCGGCCTTTATTCACATTCTTGCCCGCCTGATGAATGCTCATC
CGGAATTCCGTATGGCAATGAAAGACGGTGAGCTGGTGATATGGGATAGTGTTC
ACCCTTGTTACACCGTTTTCCATGAGCAAACTGAAACGTTTTCATCGCTCTGGAG
TGAATACCACGACGATTTCCGGCAGTTTCTACACATATATTCGCAAGATGTGGC
GTGTTACGGTGAAAACCTGGCCTATTTCCCTAAAGGGTTTATTGAGAATATGTTT
TTCGTCTCAGCgAATCCCTGGGTGAGTTTCACCAGTTTTGATTTAAACGTGGCCA
ATATGGACAACTTCTTCGCCCCCGTTTTCACCATGGGCAAATATTATACGCAAGG
CGACAAGGTGCTGATGCCGCTGGCGATTCAGGTTCATCATGCCGTCTGTGATG

GCTTCCATGTCGGCAGAATGCTTAATGAATTACAACAGTACTGCGATGAGTGGC
AGGGCGGGGCGTAATTTTTTTAAGGCAGTTATTGGTGCCCTTAAACGCCTGGTG
CTACGCCTGAATAAGTGATAATAAGCGGATGAATGGCAGAAATTCGAAAGCAAA
TTCGACCCGGTCGTCGGTTCAGGGCAGGGTCGTTAAATAGCCGCTTATGTCTAT
TGCTGGTTTACCGGTTTATTGACTACCGGAAGCAGTGTGACCGTGTGCTTCTCA
AATGCCTGAGGCCAGTTTGCTCAGGCTCTCCCCGTGGAGGTAATAATTGACGAT
ATGATCATTTATTCTGCCTCCCAGAGCCTGATAAAAACGGTTAGCGCTTCGTTAA
TACAGATGTAGGTGTTCCACAGGGTAGCCAGCAGCATCCTGCGATGCAGATCC
GGAACATAATGGTGCAGGGCGCTTGTTTCGGCGTGGGTATGGTGGCAGGCCCC
GTGGCCGGGGGACTGTTGGGCGCTGCCGGCACCTGTCCTACGAGTTGCATGAT
AAAGAAGACAGTCATAAGTGCGGCGACGATAGTCATGCCCCGCGCCCACCGGA
AGGAGCTACCGGACAGCGGTGCGGACTGTTGTAACTCAGAATAAGAAATGAGG
CCGCTCATGGCGTTGACTCTCAGTCATAGTATCGTGGTATCACCGGTTGGTTCC
ACTCTCTGTTGCGGGCAACTTCAGCAGCACGTAGGGGACTTCCGCGTTTCCAGA
CTTTACGAAACACGGAAACCGAAGACCATTCATGTTGTTGCTCAGGTCGCAGAC
GTTTTGCAGCAGCAGTCGCTTCACGTTCGCTCGCGTATCGGTGATTCATTCTGC
TAACCAGTAAGGCAACCCCGCCAGCCTAGCCGGGTCCTCAACGACAGGAGCAC
GATCATGCGCACCCGTGGCCAGGACCCAACGCTGCCCGAGATGCGCCGCGTG
CGGCTGCTGGAGATGGCGGACGCGATGGATATGTTCTGCCAAGGGTTGGTTTG
CGCATTCACAGTTCTCCGCAAGAATTGATTGGCTCCAATTCTTGGAGTGGTGAA
TCCGTTAGCGAGGTGCCGCCGGCTTCCATTCAGGTCGAGGTGGCCCGGCTCCA
TGCACCGCGACGCAACGCGGGGAGGCAGACAAGGTATAGGGCGGCGCCTACA
ATCCATGCCAACCCGTTCCATGTGCTCGCCGAGGCGGCATAAATCGCCGTGAC
GATCAGCGGTCCAGTGATCGAAGTTAGGCTGGTAAGAGCCGCGAGCGATCCTT
GAAGCTGTCCCTGATGGTCGTCATCTACCTGCCTGGACAGCATGGCCTGCAAC
GCGGGCATCCCGATGCCGCCGGAAGCGAGAAGAATCATAATGGGGAAGGCCAT
CCAGCCTCGCGTCGCGAACGCCAGCAAGACGTAGCCCAGCGCGTCGGCCGCC
ATGCCGGCGATAATGGCCTGCTTCTCGCCGAAACGTTTGGTGGCGGGACCAGT
GACGAAGGCTTGAGCGAGGGCGTGCAAGATTCCGAATACCGCAAGCGACAGGC
CGATCATCGTCGCGCTCCAGCGAAAGCGGTCCTCGCCGAAAATGACCCAGAGC
GCTGCCGGCACCTGTCCTACGAGTTGCATGATAAAGAAGACAGTCATAAGTGCG
GCGACGATAGTCATGCCCCGCGCCCACCGGAAGGAGCTGACTGGGTTGAAGG
CTCTCAAGGGCATCGGTCGACGCTCTCCCTTATGCGACTCCTGCATTAGGAAGC
AGCCCAGTAGTAGGTTGAGGCCGTTGAGCACCGCCGCCGCAAGGAATGGTGCA
TGCAAGGAGATGGCGCCCAACAGTCCCCCGGCCACGGGGCCTGCCACCATAC
CCACGCCGAAACAAGCGCTCATGAGCCCGAAGTGGCGAGCCCGATCTTCCCCA
TCGGTGATGTCGGCGATATAGGCGCCAGCAACCGCACCTGTGGCGCCGGTGAT
GCCGGCCACGATGCGTCCGGCGTAGAGGATCCACAGGACGGGTGTGGTCGCC
ATGATCGCGTAGTCGATAGTGGCTCCAAGTAGCGAAGCGAGCAGGACTGGGCG
GCGGCCAAAGCGGTCGGACAGTGCTCCGAGAACGGGTGCGCATAGAAATTGCA
TCAACGCATATAGCGCTAGCAGCACGCCATAGTGACTGGCGATGCTGTCGGAAT
GGACGATATCCCGCAAGAGGCCCGGCAGTACCGGCATAACCAAGCCTATGCCT
ACAGCATCCAGGGTGACGGTGCCGAGGATGACGATGAGCGCATTGTTAGATTT
CATACACGGTGCCTGACTGCGTTAGCAATTTAACTGTGATAAACTACCGCATTAA

AGCTTATCGATGATAAGCTGTCAAACATGAGAATTACAACTTATATCGTATGGGG
CTGACTTCAGGTGCTACATTTGAAGAGATAAATTGCACTGAAATCTAGAAATATT
TTATCTGATTAATAAGATGATCTTCTTGAGATCGTTTTGGTCTGCGCGTAATCTCT
TGCTCTGAAAACGAAAAAACCGCCTTGCAGGGCGGTTTTTCGAAGGTTCTCTGA
GCTACCAACTCTTTGAACCGAGGTAACTGGCTTGGAGGAGCGCAGTCACCAAAA
CTTGTCCT

pRC2301

GAATTCCGGATGAGCATTCATCAGGCGGGCAAGAATGTGAATAAAGGCCGGAT
AAAACTTGTGCTTATTTTTCTTTACGGTCTTTAAAAAGGCCGTAATATCCAGCTGA
ACGGTCTGGTTATAGGTACATTGAGCAACTGACTGAAATGCCTCAAAATGTTCTT
TACGATGCCATTGGGATATATCAACGGTGGTATATCCAGTGATTTTTTTCTCCAT
TTTAGCTTCCTTAGCTCCTGAAAATCTCGATAACTCAAAAAATACGCCCGGTAGT
GATCTTATTTCATTATGGTGAAAGTTGGAACCTCTTACGTGCCGATCAACGTCTC
ATTTTCGCCAAAAGTTGGCCCAGGGCTTCCCGGTATCAACAGGGACACCAGGAT
TTATTTATTCTGCGAAGTGATCTTCCGTCACAGGTATTTATTCGGCGCAAAGTGC
GTCGGGTGATGCTGCCAACTTACTGATTTAGTGTATGATGGTGTTTTTGAGGTG
CTCCAGTGGCTTCTGTTTCTATCAGCTGTCCCTCCTGTTCAGCTACTGACGGGG
TGGTGCGTAACGGCAAAAGCACCGCCGGACATCAGCGCTAGCGGAGTGTATAC
TGGCTTACTATGTTGGCACTGATGAGGGTGTCAGTGAAGTGCTTCATGTGGCAG
GAGAAAAAAGGCTGCACCGGTGCGTCAGCAGAATATGTGATACAGGATATATTC
CGCTTCCTCGCTCACTGACTCGCTACGCTCGGTCGTTCGACTGCGGCGAGCGG
AAATGGCTTACGAACGGGGCGGAGATTTCCTGGAAGATGCCAGGAAGATACTTA
ACAGGGAAGTGAGAGGGCCGCGGCAAAGCCGTTTTTCCATAGGCTCCGCCCCC
CTGACAAGCATCACGAAATCTGACGCTCAAATCAGTGGTGGCGAAACCCGACA
GGACTATAAAGATACCAGGCGTTTCCCCCTGGCGGCTCCCTCGTGCGCTCTCCT
GTTCCTGCCTTTCGGTTTACCGGTGTCATTCCGCTGTTATGGCCGCGTTTGTCT
CATTCCACGCCTGACACTCAGTTCCGGGTAGGCAGTTCGCTCCAAGCTGGACT
GTATGCACGAACCCCCCGTTCAGTCCGACCGCTGCGCCTTATCCGGTAACTATC
GTCTTGAGTCCAACCCGGAAAGACATGCAAAAGCACCACTGGCAGCAGCCACT
GGTAATTGATTTAGAGGAGTTAGTCTTGAAGTCATGCGCCGGTTAAGGCTAAAC
TGAAAGGACAAGTTTTGGTGACTGCGCTCCTCCAAGCCAGTTACCTCGGTTCAA
AGAGTTGGTAGCTCAGAGAACCTTCGAAAAACCGCCCTGCAAGGCGGTTTTTTC
GTTTTCAGAGCAAGAGATTACGCGCAGACCAAAACGATCTCAAGAAGATCATCT
TATTAATCAGATAAAATATTTCTAGATTTCAGTGCAATTTATCTCTTCAAATGTAG
CACCTGAAGTCAGCCCCATACGATATAAGTTGTAATTCTCATGTTTGACAGCTTA
TCATCGATAAGCTTTAATGCGGTAGTTTATCACAGTTAAATTGCTAACGCAGTCA
GGCACCGTGTATGAAATCTAACAATGCGCTCATCGTCATCCTCGGCACCGTCAC
CCTGGATGCTGTAGGCATAGGCTTGGTTATGCCGGTACTGCCGGGCCTCTTGC
GGGATTACGAAATCATCCTGTGGAGCTTAGTAGGTTTAGCAAGATGGCAGCGCC
TAAATGTAGAATGATAAAAGGATTAAGAGATTAATTTCCCTAAAAATGATAAAACA
AGCGTTTTGAAAGCGCTTGTTTTTTTGGTTTGCAGTCAGAGTAGAATAGAAGTAT
CAAAAAAAGCACCGACTCGGTGCCACTTTTTCAAGTTGATAACGGACTAGCCTT

ATTTTAACTTGCTATGCTGTTTTGAATGGTTCCAACAAGATTATTTTATAACTTTTA
TAACAAATAATCAAGGAGAAATTCAAAGAAATTTATCAGCCATAAAACAATACTTA
ATACTATAGAATGATAACAAAATAAACTACTTTTTAAAAGAATTTTGTGTTATAATC
TATTTATTATTAAGTATTGGGTAATATTTTTTGAAGAGATATTTTGAAAAAGAAAAA
TTAAAGCATATTAAACTAATTTCGGAGGTCATTAAAACTATTATTGAAATCATCAA
ACTCATTATGGATTTAATTTAAACTTTTTATTTTAGGAGGCAAAAATGGATAAGAA
ATACTCAATAGGCTTAGCTATCGGCACAAATAGCGTCGGATGGGCGGTGATCAC
TGATGAATATAAGGTTCCGTCTAAAAAGTTCAAGGTTCTGGGAAATACAGACCG
CCACAGTATCAAAAAAAATCTTATAGGGGCTCTTTTATTTGACAGTGGAGAGACA
GCGGAAGCGACTCGTCTCAAACGGACAGCTCGTAGAAGGTATACACGTCGGAA
GAATCGTATTTGTTATCTACAGGAGATTTTTTCAAATGAGATGGCGAAAGTAGAT
GATAGTTTCTTTCATCGACTTGAAGAGTCTTTTTTGGTGGAAGAAGACAAGAAGC
ATGAACGTCATCCTATTTTTGGAAATATAGTAGATGAAGTTGCTTATCATGAGAA
ATATCCAACTATCTATCATCTGCGAAAAAAATTGGTAGATTCTACTGATAAAGCG
GATTTGCGCTTAATCTATTTGGCCTTAGCGCATATGATTAAGTTTCGTGGTCATT
TTTTGATTGAGGGAGATTTAAATCCTGATAATAGTGATGTGGACAAACTATTTAT
CCAGTTGGTACAAACCTACAATCAATTATTTGAAGAAAACCCTATTAACGCAAGT
GGAGTAGATGCTAAAGCGATTCTTTCTGCACGATTGAGTAAATCAAGACGATTA
GAAAATCTCATTGCTCAGCTCCCCGGTGAGAAGAAAAATGGCTTATTTGGGAAT
CTCATTGCTTTGTCATTGGGTTTGACCCCTAATTTTAAATCAAATTTTGATTTGGC
AGAAGATGCTAAATTACAGCTTTCAAAAGATACTTACGATGATGATTTAGATAATT
TATTGGCGCAAATTGGAGATCAATATGCTGATTTGTTTTTGGCAGCTAAGAATTT
ATCAGATGCTATTTTACTTTCAGATATCCTAAGAGTAAATACTGAAATAACTAAGG
CTCCCCTATCAGCTTCAATGATTAAACGCTACGATGAACATCATCAAGACTTGAC
TCTTTTAAAAGCTTTAGTTCGACAACAACTTCCAGAAAAGTATAAAGAAATCTTTT
TTGATCAATCAAAAAACGGATATGCAGGTTATATTGATGGGGGAGCTAGCCAAG
AAGAATTTTATAAATTTATCAAACCAATTTTAGAAAAAATGGATGGTACTGAGGAA
TTATTGGTGAAACTAAATCGTGAAGATTTGCTGCGCAAGCAACGGACCTTTGAC
AACGGCTCTATTCCCCATCAAATTCACTTGGGTGAGCTGCATGCTATTTTGAGAA
GACAAGAAGACTTTTATCCATTTTTAAAAGACAATCGTGAGAAGATTGAAAAAAT
CTTGACTTTTCGAATTCCTTATTATGTTGGTCCATTGGCGCGTGGCAATAGTCGT
TTTGCATGGATGACTCGGAAGTCTGAAGAAACAATTACCCCATGGAATTTTGAAG
AAGTTGTCGATAAAGGTGCTTCAGCTCAATCATTTATTGAACGCATGACAAACTT
TGATAAAAATCTTCCAAATGAAAAAGTACTACCAAAACATAGTTTGCTTTATGAGT
ATTTTACGGTTTATAACGAATTGACAAAGGTCAAATATGTTACTGAAGGAATGCG
AAAACCAGCATTTCTTTCAGGTGAACAGAAGAAAGCCATTGTTGATTTACTCTTC
AAAACAAATCGAAAAGTAACCGTTAAGCAATTAAAAGAAGATTATTTCAAAAAAAT
AGAATGTTTTGATAGTGTTGAAATTTCAGGAGTTGAAGATAGATTTAATGCTTCAT
TAGGTACCTACCATGATTTGCTAAAAATTATTAAAGATAAAGATTTTTTGGATAAT
GAAGAAAATGAAGATATCTTAGAGGATATTGTTTTAACATTGACCTTATTTGAAGA
TAGGGAGATGATTGAGGAAAGACTTAAAACATATGCTCACCTCTTTGATGATAAG
GTGATGAAACAGCTTAAACGTCGCCGTTATACTGGTTGGGGACGTTTGTCTCGA
AAATTGATTAATGGTATTAGGGATAAGCAATCTGGCAAAACAATATTAGATTTTTT
GAAATCAGATGGTTTTGCCAATCGCAATTTTATGCAGCTGATCCATGATGATAGT

TTGACATTTAAAGAAGACATTCAAAAAGCACAAGTGTCTGGACAAGGCGATAGTT
TACATGAACATATTGCAAATTTAGCTGGTAGCCCTGCTATTAAAAAAGGTATTTTA
CAGACTGTAAAAGTTGTTGATGAATTGGTCAAAGTAATGGGGCGGCATAAGCCA
GAAAATATCGTTATTGAAATGGCACGTGAAAATCAGACAACTCAAAAGGGCCAG
AAAAATTCGCGAGAGCGTATGAAACGAATCGAAGAAGGTATCAAAGAATTAGGA
AGTCAGATTCTTAAAGAGCATCCTGTTGAAAATACTCAATTGCAAAATGAAAAGC
TCTATCTCTATTATCTCCAAAATGGAAGAGACATGTATGTGGACCAAGAATTAGA
TATTAATCGTTTAAGTGATTATGATGTCGATGCCATTGTTCCACAAAGTTTCCTTA
AAGACGATTCAATAGACAATAAGGTCTTAACGCGTTCTGATAAAAATCGTGGTAA
ATCGGATAACGTTCCAAGTGAAGAAGTAGTCAAAAAGATGAAAAACTATTGGAG
ACAACTTCTAAACGCCAAGTTAATCACTCAACGTAAGTTTGATAATTTAACGAAA
GCTGAACGTGGAGGTTTGAGTGAACTTGATAAAGCTGGTTTTATCAAACGCCAA
TTGGTTGAAACTCGCCAAATCACTAAGCATGTGGCACAAATTTTGGATAGTCGCA
TGAATACTAAATACGATGAAAATGATAAACTTATTCGAGAGGTTAAAGTGATTAC
CTTAAAATCTAAATTAGTTTCTGACTTCCGAAAAGATTTCCAATTCTATAAAGTAC
GTGAGATTAACAATTACCATCATGCCCATGATGCGTATCTAAATGCCGTCGTTGG
AACTGCTTTGATTAAGAAATATCCAAAACTTGAATCGGAGTTTGTCTATGGTGAT
TATAAAGTTTATGATGTTCGTAAAATGATTGCTAAGTCTGAGCAAGAAATAGGCA
AAGCAACCGCAAAATATTTCTTTTACTCTAATATCATGAACTTCTTCAAAACAGAA
ATTACACTTGCAAATGGAGAGATTCGCAAACGCCCTCTAATCGAAACTAATGGG
GAAACTGGAGAAATTGTCTGGGATAAAGGGCGAGATTTTGCCACAGTGCGCAAA
GTATTGTCCATGCCCCAAGTCAATATTGTCAAGAAAACAGAAGTACAGACAGGC
GGATTCTCCAAGGAGTCAATTTTACCAAAAAGAAATTCGGACAAGCTTATTGCTC
GTAAAAAAGACTGGGATCCAAAAAAATATGGTGGTTTTGATAGTCCAACGGTAG
CTTATTCAGTCCTAGTGGTTGCTAAGGTGGAAAAAGGGAAATCGAAGAAGTTAA
AATCCGTTAAAGAGTTACTAGGGATCACAATTATGGAAAGAAGTTCCTTTGAAAA
AAATCCGATTGACTTTTTAGAAGCTAAAGGATATAAGGAAGTTAAAAAAGACTTA
ATCATTAAACTACCTAAATATAGTCTTTTTGAGTTAGAAAACGGTCGTAAACGGA
TGCTGGCTAGTGCCGGAGAATTACAAAAAGGAAATGAGCTGGCTCTGCCAAGC
AAATATGTGAATTTTTTATATTTAGCTAGTCATTATGAAAAGTTGAAGGGTAGTCC
AGAAGATAACGAACAAAAACAATTGTTTGTGGAGCAGCATAAGCATTATTTAGAT
GAGATTATTGAGCAAATCAGTGAATTTTCTAAGCGTGTTATTTTAGCAGATGCCA
ATTTAGATAAAGTTCTTAGTGCATATAACAAACATAGAGACAAACCAATACGTGA
ACAAGCAGAAAATATTATTCATTTATTTACGTTGACGAATCTTGGAGCTCCCGCT
GCTTTTAAATATTTTGATACAACAATTGATCGTAAACGATATACGTCTACAAAAGA
AGTTTTAGATGCCACTCTTATCCATCAATCCATCACTGGTCTTTATGAAACACGC
ATTGATTTGAGTCAGCTAGGAGGTGACTGAAGTATATTTTAGATGAAGATTATTT
CTTAATAACTAAAAATATGGTATAATACTCTTAATAAATGCAGTAATACAGGGGCT
TTTCAAGACTGAAGTCTAGCTGAGACAAATAGTGCGATTACGAAATTTTTTAGAC
AAAAATAGTCTACGAGGTTTTAGAGCTATGCTGTTTTGAATGGTCCCAAAACTGA
GACCAGTCTCGGAAGCTCAAAGGTCTCGTTTTAGAGCTATGCTGTTTTGAATGG
TCCCAAAACTTCAGCACACTGAGACTTGTTGAGTTCCATGTTTTAGAGCTATGCT
GTTTTGAATGGACTCCATTCAACATTGCCGATGATAACTTGAGAAAGAGGGTTAA
TACCAGCAGTCGGATACCTTCCTATTCTTTCTGTTAAAGCGTTTTCATGTTATAAT

AGGCAAAAGAAGAGTAGTGTGATCGTCCATTCCGACAGCATCGCCAGTCACTAT
GGCGTGCTGCTAGCGCTATATGCGTTGATGCAATTTCTATGCGCACCCGTTCTC
GGAGCACTGTCCGACCGCTTTGGCCGCCGCCCAGTCCTGCTCGCTTCGCTACT
TGGAGCCACTATCGACTACGCGATCATGGCGACCACACCCGTCCTGTGGATCC
TCTACGCCGGACGCATCGTGGCCGGCATCACCGGCGCCACAGGTGCGGTTGCT
GGCGCCTATATCGCCGACATCACCGATGGGGAAGATCGGGCTCGCCACTTCGG
GCTCATGAGCGCTTGTTTCGGCGTGGGTATGGTGGCAGGCCCCGTGGCCGGG
GGACTGTTGGGCGCCATCTCCTTGCATGCACCATTCCTTGCGGCGGCGGTGCT
CAACGGCCTCAACCTACTACTGGGCTGCTTCCTAATGCAGGAGTCGCATAAGGG
AGAGCGTCGACCGATGCCCTTGAGAGCCTTCAACCCAGTCAGCTCCTTCCGGT
GGGCGCGGGGCATGACTATCGTCGCCGCACTTATGACTGTCTTCTTTATCATGC
AACTCGTAGGACAGGTGCCGGCAGCGCTCTGGGTCATTTTCGGCGAGGACCGC
TTTCGCTGGAGCGCGACGATGATCGGCCTGTCGCTTGCGGTATTCGGAATCTTG
CACGCCCTCGCTCAAGCCTTCGTCACTGGTCCCGCCACCAAACGTTTCGGCGA
GAAGCAGGCCATTATCGCCGGCATGGCGGCCGACGCGCTGGGCTACGTCTTGC
TGGCGTTCGCGACGCGAGGCTGGATGGCCTTCCCCATTATGATTCTTCTCGCTT
CCGGCGGCATCGGGATGCCCGCGTTGCAGGCCATGCTGTCCAGGCAGGTAGA
TGACGACCATCAGGGACAGCTTCAAGGATCGCTCGCGGCTCTTACCAGCCTAA
CTTCGATCATTGGACCGCTGATCGTCACGGCGATTTATGCCGCCTCGGCGAGC
ACATGGAACGGGTTGGCATGGATTGTAGGCGCCGCCCTATACCTTGTCTGCCTC
CCCGCGTTGCGTCGCGGTGCATGGAGCCGGGCCACCTCGACCTGAATGGAAG
CCGGCGGCACCTCGCTAACGGATTCACCACTCCAAGAATTGGAGCCAATCAATT
CTTGCGGAGAACTGTGAATGCGCAAACCAACCCTTGGCAGAACATATCCATCGC
GTCCGCCATCTCCAGCAGCCGCACGCGGCGCATCTCGGGCAGCGTTGGGTCCT
GGCCACGGGTGCGCATGATCGTGCTCCTGTCGTTGAGGACCCGGCTAGGCTGG
CGGGGTTGCCTTACTGGTTAGCAGAATGAATCACCGATACGCGAGCGAACGTG
AAGCGACTGCTGCTGCAAAACGTCTGCGACCTGAGCAACAACATGAATGGTCTT
CGGTTTCCGTGTTTCGTAAAGTCTGGAAACGCGGAAGTCCCCTACGTGCTGCTG
AAGTTGCCCGCAACAGAGAGTGGAACCAACCGGTGATACCACGATACTATGACT
GAGAGTCAACGCCATGAGCGGCCTCATTTCTTATTCTGAGTTACAACAGTCCGC
ACCGCTGTCCGGTAGCTCCTTCCGGTGGGCGCGGGGCATGACTATCGTCGCCG
CACTTATGACTGTCTTCTTTATCATGCAACTCGTAGGACAGGTGCCGGCAGCGC
CCAACAGTCCCCCGGCCACGGGGCCTGCCACCATACCCACGCCGAAACAAGC
GCCCTGCACCATTATGTTCCGGATCTGCATCGCAGGATGCTGCTGGCTACCCTG
TGGAACACCTACATCTGTATTAACGAAGCGCTAACCGTTTTTATCAGGCTCTGG
GAGGCAGAATAAATGATCATATCGTCAATTATTACCTCCACGGGGAGAGCCTGA
GCAAACTGGCCTCAGGCATTTGAGAAGCACACGGTCACACTGCTTCCGGTAGTC
AATAAACCGGTAAACCAGCAATAGACATAAGCGGCTATTTAACGACCCTGCCCT
GAACCGACGACCGGGTCGAATTTGCTTTCGAATTTCTGCCATTCATCCGCTTATT
ATCACTTATTCAGGCGTAGCACCAGGCGTTTAAGGGCACCAATAACTGCCTTAA
AAAAATTACGCCCCGCCCTGCCACTCATCGCAGTACTGTTGTAATTCATTAAGCA
TTCTGCCGACATGGAAGCCATCACAGACGGCATGATGAACCTGAATCGCCAGC
GGCATCAGCACCTTGTCGCCTTGCGTATAATATTTGCCCATGGTGAAAACGGGG
GCGAAGAAGTTGTCCATATTGGCCACGTTTAAATCAAAACTGGTGAAACTCACC

CAGGGATTGGCTGAGACGAAAAACATATTCTCAATAAACCCTTTAGGGAAATAG
GCCAGGTTTTCACCGTAACACGCCACATCTTGCGAATATATGTGTAGAAACTGC
CGGAAATCGTCGTGGTATTCACTCCAGAGCGATGAAAACGTTTCAGTTTGCTCA
TGGAAAACGGTGTAACAAGGGTGAACACTATCCCATATCACCAGCTCACCGTCT
TTCATTGCCATACG

pRC2302

GAATTCCGGATGAGCATTCATCAGGCGGGCAAGAATGTGAATAAAGGCCGGAT
AAAACTTGTGCTTATTTTTCTTTACGGTCTTTAAAAAGGCCGTAATATCCAGCTGA
ACGGTCTGGTTATAGGTACATTGAGCAACTGACTGAAATGCCTCAAAATGTTCTT
TACGATGCCATTGGGATATATCAACGGTGGTATATCCAGTGATTTTTTTCTCCAT
TTTAGCTTCCTTAGCTCCTGAAAATCTCGATAACTCAAAAAATACGCCCGGTAGT
GATCTTATTTCATTATGGTGAAAGTTGGAACCTCTTACGTGCCGATCAACGTCTC
ATTTTCGCCAAAAGTTGGCCCAGGGCTTCCCGGTATCAACAGGGACACCAGGAT
TTATTTATTCTGCGAAGTGATCTTCCGTCACAGGTATTTATTCGGCGCAAAGTGC
GTCGGGTGATGCTGCCAACTTACTGATTTAGTGTATGATGGTGTTTTTGAGGTG
CTCCAGTGGCTTCTGTTTCTATCAGCTGTCCCTCCTGTTCAGCTACTGACGGGG
TGGTGCGTAACGGCAAAAGCACCGCCGGACATCAGCGCTAGCGGAGTGTATAC
TGGCTTACTATGTTGGCACTGATGAGGGTGTCAGTGAAGTGCTTCATGTGGCAG
GAGAAAAAAGGCTGCACCGGTGCGTCAGCAGAATATGTGATACAGGATATATTC
CGCTTCCTCGCTCACTGACTCGCTACGCTCGGTCGTTCGACTGCGGCGAGCGG
AAATGGCTTACGAACGGGGCGGAGATTTCCTGGAAGATGCCAGGAAGATACTTA
ACAGGGAAGTGAGAGGGCCGCGGCAAAGCCGTTTTTCCATAGGCTCCGCCCCC
CTGACAAGCATCACGAAATCTGACGCTCAAATCAGTGGTGGCGAAACCCGACA
GGACTATAAAGATACCAGGCGTTTCCCCCTGGCGGCTCCCTCGTGCGCTCTCCT
GTTCCTGCCTTTCGGTTTACCGGTGTCATTCCGCTGTTATGGCCGCGTTTGTCT
CATTCCACGCCTGACACTCAGTTCCGGGTAGGCAGTTCGCTCCAAGCTGGACT
GTATGCACGAACCCCCCGTTCAGTCCGACCGCTGCGCCTTATCCGGTAACTATC
GTCTTGAGTCCAACCCGGAAAGACATGCAAAAGCACCACTGGCAGCAGCCACT
GGTAATTGATTTAGAGGAGTTAGTCTTGAAGTCATGCGCCGGTTAAGGCTAAAC
TGAAAGGACAAGTTTTGGTGACTGCGCTCCTCCAAGCCAGTTACCTCGGTTCAA
AGAGTTGGTAGCTCAGAGAACCTTCGAAAAACCGCCCTGCAAGGCGGTTTTTTC
GTTTTCAGAGCAAGAGATTACGCGCAGACCAAAACGATCTCAAGAAGATCATCT
TATTAATCAGATAAAATATTTCTAGATTTCAGTGCAATTTATCTCTTCAAATGTAG
CACCTGAAGTCAGCCCCATACGATATAAGTTGTAATTCTCATGTTTGACAGCTTA
TCATCGATAAGCTTTAATGCGGTAGTTTATCACAGTTAAATTGCTAACGCAGTCA
GGCACCGTGTATGAAATCTAACAATGCGCTCATCGTCATCCTCGGCACCGTCAC
CCTGGATGCTGTAGGCATAGGCTTGGTTATGCCGGTACTGCCGGGCCTCTTGC
GGGATTACGAAATCATCCTGTGGAGCTTAGTAGGTTTAGCAAGATGGCAGCGCC
TAAATGTAGAATGATAAAAGGATTAAGAGATTAATTTCCCTAAAAATGATAAAACA
AGCGTTTTGAAAGCGCTTGTTTTTTTGGTTTGCAGTCAGAGTAGAATAGAAGTAT
CAAAAAAAGCACCGACTCGGTGCCACTTTTTCAAGTTGATAACGGACTAGCCTT
ATTTTAACTTGCTATGCTGTTTTGAATGGTTCCAACAAGATTATTTTATAACTTTTA

TAACAAATAATCAAGGAGAAATTCAAAGAAATTTATCAGCCATAAAACAATACTTA
ATACTATAGAATGATAACAAAATAAACTACTTTTTAAAAGAATTTTGTGTTATAATC
TATTTATTATTAAGTATTGGGTAATATTTTTTGAAGAGATATTTTGAAAAAGAAAAA
TTAAAGCATATTAAACTAATTTCGGAGGTCATTAAAACTATTATTGAAATCATCAA
ACTCATGCATCATATGGAAATGATGCTCGATAAGAAACAGATTCGTGCGATCTTT
CTCTTTGAGTTTAAAATGGGTCGCAAAGCGGCGGAGACGACGCGTAATATTAAC
AACGCGTTCGGTCCTGGCACCGCGAACGAGCGTACCGTGCAATGGTGGTTCAA
AAAGTTTCGCAAAGGCGACGAATCTCTGGAGGACGAAGAGCGTTCTGGCCGCC
CGTCCGAGGTTGACAACGACCAGCTGCGTGCAATCATCGAAGCTGATCCGCTG
ACTACCACCCGCGAAGTTGCTGAAGAACTGAATGTGGATCACTCTACTGTGGTT
CGCCACCTGAAACAGATCGGTAAAGTAAAAAAACTGGACAAATGGGTTCCTCAT
GAACTGTCTGAAAACCAGAAAAACCGTCGTTTCGAAGTTAGCTCCTCTCTGATTC
TGCGTAACAACAACGAACCGTTCCTGGATCGTATCGTAACCTGTGATGAGAAAT
GGATTCTGTATGATAACCGTCGCCGCTCTGCTCAGTGGCTGGATCGCGAAGAA
GCTCCAAAACACTTCCCGAAACCGAATCTGCACCAGAAGAAAGTCATGGTAACC
GTATGGTGGTCTGCCGCAGGTGTTATCCACTATTCCTTCCTGAACCCGGGCGAA
ACTATCACCAGCGAAAAATACTGCCAGCAGATTGACGAAATGCACCGTAAACTG
CAGCGTCTGCAGCCAGCACTGGTGAATCGTAAAGGTCCGATCCTGCTGCATGAT
AACGCCCGTCCGCACGTTGCCCAACCGACCCTGCAGAAACTGAACGAACTGGG
CTATGAAGTTCTGCCACACCCGCCGTACTCCCCGGATCTGTCCCCGACTGACTA
CCATTTCTTCAAGCATCTGGACAACTTCCTGCAGGGTAAACGTTTTCACAACCAA
CAGGACGCAGAAAACGCTTTCCAGGAGTTCGTCGAAAGCCGTTCCACTGACTTC
TACGCGACCGGTATCAACAAGCTGATCAGCCGTTGGCAGAAATGCGTGGACTG
TAACGGCAGCTACTTCGATtctagaGGAGGTGGCTCAGAAGGTGGCGGATCTGAA
GGTGGCTCTGGAactagtATGAGCGATAAAATTATTCACCTGACTGACGACAGTTT
TGACACGGATGTACTCAAAGCGGACGGGGCGATCCTCGTCGATTTCTGGGCAG
AGTGGTGCGGTCCGTGCAAAATGATCGCCCCGATTCTGGATGAAATCGCTGAC
GAATATCAGGGCAAACTGACCGTTGCAAAACTGAACATCGATCAAAACCCTGGC
ACTGCGCCGAAATATGGCATCCGTGGTATCCCGACTCTGCTGCTGTTCAAAAAC
GGTGAAGTGGCGGCAACCAAAGTGGGTGCACTGTCTAAAGGTCAGTTGAAAGA
GTTCCTCGACGCTAACCTGGCCGGTTCTGGTTCTGGCCATATGCACCATCATCA
TCATCATTCTTCTGGTCTGGTGCCACGCGGTTCTGGTATGAAAGAAACCGCTGC
TGCTAAATTCGAACGCCAGCACATGGACAGCCCAGATCTGGGTACCGACGACG
ACGACAAGGCCATGGCTGATATCCTCGAGATGGATAAGAAATACTCAATAGGCT
TAGCTATCGGCACAAATAGCGTCGGATGGGCGGTGATCACTGATGAATATAAGG
TTCCGTCTAAAAAGTTCAAGGTTCTGGGAAATACAGACCGCCACAGTATCAAAA
AAAATCTTATAGGGGCTCTTTTATTTGACAGTGGAGAGACAGCGGAAGCGACTC
GTCTCAAACGGACAGCTCGTAGAAGGTATACACGTCGGAAGAATCGTATTTGTT
ATCTACAGGAGATTTTTTCAAATGAGATGGCGAAAGTAGATGATAGTTTCTTTCA
TCGACTTGAAGAGTCTTTTTTGGTGGAAGAAGACAAGAAGCATGAACGTCATCC
TATTTTTGGAAATATAGTAGATGAAGTTGCTTATCATGAGAAATATCCAACTATCT
ATCATCTGCGAAAAAAATTGGTAGATTCTACTGATAAAGCGGATTTGCGCTTAAT
CTATTTGGCCTTAGCGCATATGATTAAGTTTCGTGGTCATTTTTTGATTGAGGGA
GATTTAAATCCTGATAATAGTGATGTGGACAAACTATTTATCCAGTTGGTACAAA

CCTACAATCAATTATTTGAAGAAAACCCTATTAACGCAAGTGGAGTAGATGCTAA
AGCGATTCTTTCTGCACGATTGAGTAAATCAAGACGATTAGAAAATCTCATTGCT
CAGCTCCCCGGTGAGAAGAAAAATGGCTTATTTGGGAATCTCATTGCTTTGTCAT
TGGGTTTGACCCCTAATTTTAAATCAAATTTTGATTTGGCAGAAGATGCTAAATTA
CAGCTTTCAAAAGATACTTACGATGATGATTTAGATAATTTATTGGCGCAAATTG
GAGATCAATATGCTGATTTGTTTTTGGCAGCTAAGAATTTATCAGATGCTATTTTA
CTTTCAGATATCCTAAGAGTAAATACTGAAATAACTAAGGCTCCCCTATCAGCTT
CAATGATTAAACGCTACGATGAACATCATCAAGACTTGACTCTTTTAAAAGCTTT
AGTTCGACAACAACTTCCAGAAAAGTATAAAGAAATCTTTTTTGATCAATCAAAAA
ACGGATATGCAGGTTATATTGATGGGGGAGCTAGCCAAGAAGAATTTTATAAATT
TATCAAACCAATTTTAGAAAAAATGGATGGTACTGAGGAATTATTGGTGAAACTA
AATCGTGAAGATTTGCTGCGCAAGCAACGGACCTTTGACAACGGCTCTATTCCC
CATCAAATTCACTTGGGTGAGCTGCATGCTATTTTGAGAAGACAAGAAGACTTTT
ATCCATTTTTAAAAGACAATCGTGAGAAGATTGAAAAAATCTTGACTTTTCGAATT
CCTTATTATGTTGGTCCATTGGCGCGTGGCAATAGTCGTTTTGCATGGATGACT
CGGAAGTCTGAAGAAACAATTACCCCATGGAATTTTGAAGAAGTTGTCGATAAA
GGTGCTTCAGCTCAATCATTTATTGAACGCATGACAAACTTTGATAAAAATCTTC
CAAATGAAAAAGTACTACCAAAACATAGTTTGCTTTATGAGTATTTTACGGTTTAT
AACGAATTGACAAAGGTCAAATATGTTACTGAAGGAATGCGAAAACCAGCATTTC
TTTCAGGTGAACAGAAGAAAGCCATTGTTGATTTACTCTTCAAAACAAATCGAAA
AGTAACCGTTAAGCAATTAAAAGAAGATTATTTCAAAAAAATAGAATGTTTTGATA
GTGTTGAAATTTCAGGAGTTGAAGATAGATTTAATGCTTCATTAGGTACCTACCA
TGATTTGCTAAAAATTATTAAAGATAAAGATTTTTTGGATAATGAAGAAAATGAAG
ATATCTTAGAGGATATTGTTTTAACATTGACCTTATTTGAAGATAGGGAGATGATT
GAGGAAAGACTTAAAACATATGCTCACCTCTTTGATGATAAGGTGATGAAACAG
CTTAAACGTCGCCGTTATACTGGTTGGGGACGTTTGTCTCGAAAATTGATTAATG
GTATTAGGGATAAGCAATCTGGCAAAACAATATTAGATTTTTTGAAATCAGATGG
TTTTGCCAATCGCAATTTTATGCAGCTGATCCATGATGATAGTTTGACATTTAAA
GAAGACATTCAAAAAGCACAAGTGTCTGGACAAGGCGATAGTTTACATGAACAT
ATTGCAAATTTAGCTGGTAGCCCTGCTATTAAAAAAGGTATTTTACAGACTGTAA
AAGTTGTTGATGAATTGGTCAAAGTAATGGGGCGGCATAAGCCAGAAAATATCG
TTATTGAAATGGCACGTGAAAATCAGACAACTCAAAAGGGCCAGAAAAATTCGC
GAGAGCGTATGAAACGAATCGAAGAAGGTATCAAAGAATTAGGAAGTCAGATTC
TTAAAGAGCATCCTGTTGAAAATACTCAATTGCAAAATGAAAAGCTCTATCTCTAT
TATCTCCAAAATGGAAGAGACATGTATGTGGACCAAGAATTAGATATTAATCGTT
TAAGTGATTATGATGTCGATGCCATTGTTCCACAAAGTTTCCTTAAAGACGATTC
AATAGACAATAAGGTCTTAACGCGTTCTGATAAAAATCGTGGTAAATCGGATAAC
GTTCCAAGTGAAGAAGTAGTCAAAAAGATGAAAAACTATTGGAGACAACTTCTAA
ACGCCAAGTTAATCACTCAACGTAAGTTTGATAATTTAACGAAAGCTGAACGTGG
AGGTTTGAGTGAACTTGATAAAGCTGGTTTTATCAAACGCCAATTGGTTGAAACT
CGCCAAATCACTAAGCATGTGGCACAAATTTTGGATAGTCGCATGAATACTAAAT
ACGATGAAAATGATAAACTTATTCGAGAGGTTAAAGTGATTACCTTAAAATCTAA
ATTAGTTTCTGACTTCCGAAAAGATTTCCAATTCTATAAAGTACGTGAGATTAACA
ATTACCATCATGCCCATGATGCGTATCTAAATGCCGTCGTTGGAACTGCTTTGAT

TAAGAAATATCCAAAACTTGAATCGGAGTTTGTCTATGGTGATTATAAAGTTTATG
ATGTTCGTAAAATGATTGCTAAGTCTGAGCAAGAAATAGGCAAAGCAACCGCAA
AATATTTCTTTTACTCTAATATCATGAACTTCTTCAAAACAGAAATTACACTTGCA
AATGGAGAGATTCGCAAACGCCCTCTAATCGAAACTAATGGGGAAACTGGAGAA
ATTGTCTGGGATAAAGGGCGAGATTTTGCCACAGTGCGCAAAGTATTGTCCATG
CCCCAAGTCAATATTGTCAAGAAAACAGAAGTACAGACAGGCGGATTCTCCAAG
GAGTCAATTTTACCAAAAAGAAATTCGGACAAGCTTATTGCTCGTAAAAAAGACT
GGGATCCAAAAAAATATGGTGGTTTTGATAGTCCAACGGTAGCTTATTCAGTCCT
AGTGGTTGCTAAGGTGGAAAAAGGGAAATCGAAGAAGTTAAAATCCGTTAAAGA
GTTACTAGGGATCACAATTATGGAAAGAAGTTCCTTTGAAAAAAATCCGATTGAC
TTTTTAGAAGCTAAAGGATATAAGGAAGTTAAAAAAGACTTAATCATTAAACTACC
TAAATATAGTCTTTTTGAGTTAGAAAACGGTCGTAAACGGATGCTGGCTAGTGCC
GGAGAATTACAAAAAGGAAATGAGCTGGCTCTGCCAAGCAAATATGTGAATTTTT
TATATTTAGCTAGTCATTATGAAAAGTTGAAGGGTAGTCCAGAAGATAACGAACA
AAAACAATTGTTTGTGGAGCAGCATAAGCATTATTTAGATGAGATTATTGAGCAA
ATCAGTGAATTTTCTAAGCGTGTTATTTTAGCAGATGCCAATTTAGATAAAGTTCT
TAGTGCATATAACAAACATAGAGACAAACCAATACGTGAACAAGCAGAAAATATT
ATTCATTTATTTACGTTGACGAATCTTGGAGCTCCCGCTGCTTTTAAATATTTTGA
TACAACAATTGATCGTAAACGATATACGTCTACAAAAGAAGTTTTAGATGCCACT
CTTATCCATCAATCCATCACTGGTCTTTATGAAACACGCATTGATTTGAGTCAGC
TAGGAGGTGACTGAAGTATATTTTAGATGAAGATTATTTCTTAATAACTAAAAATA
TGGTATAATACTCTTAATAAATGCAGTAATACAGGGGCTTTTCAAGACTGAAGTC
TAGCTGAGACAAATAGTGCGATTACGAAATTTTTTAGACAAAAATAGTCTACGAG
GTTTTAGAGCTATGCTGTTTTGAATGGTCCCAAAACTGAGACCAGTCTCGGAAG
CTCAAAGGTCTCGTTTTAGAGCTATGCTGTTTTGAATGGTCCCAAAACTTCAGCA
CACTGAGACTTGTTGAGTTCCATGTTTTAGAGCTATGCTGTTTTGAATGGACTCC
ATTCAACATTGCCGATGATAACTTGAGAAAGAGGGTTAATACCAGCAGTCGGAT
ACCTTCCTATTCTTTCTGTTAAAGCGTTTTCATGTTATAATAGGCAAAAGAAGAGT
AGTGTGATCGTCCATTCCGACAGCATCGCCAGTCACTATGGCGTGCTGCTAGCG
CTATATGCGTTGATGCAATTTCTATGCGCACCCGTTCTCGGAGCACTGTCCGAC
CGCTTTGGCCGCCGCCCAGTCCTGCTCGCTTCGCTACTTGGAGCCACTATCGA
CTACGCGATCATGGCGACCACACCCGTCCTGTGGATCCTCTACGCCGGACGCA
TCGTGGCCGGCATCACCGGCGCCACAGGTGCGGTTGCTGGCGCCTATATCGCC
GACATCACCGATGGGGAAGATCGGGCTCGCCACTTCGGGCTCATGAGCGCTTG
TTTCGGCGTGGGTATGGTGGCAGGCCCCGTGGCCGGGGGACTGTTGGGCGCC
ATCTCCTTGCATGCACCATTCCTTGCGGCGGCGGTGCTCAACGGCCTCAACCTA
CTACTGGGCTGCTTCCTAATGCAGGAGTCGCATAAGGGAGAGCGTCGACCGAT
GCCCTTGAGAGCCTTCAACCCAGTCAGCTCCTTCCGGTGGGCGCGGGGCATGA
CTATCGTCGCCGCACTTATGACTGTCTTCTTTATCATGCAACTCGTAGGACAGGT
GCCGGCAGCGCTCTGGGTCATTTTCGGCGAGGACCGCTTTCGCTGGAGCGCGA
CGATGATCGGCCTGTCGCTTGCGGTATTCGGAATCTTGCACGCCCTCGCTCAAG
CCTTCGTCACTGGTCCCGCCACCAAACGTTTCGGCGAGAAGCAGGCCATTATC
GCCGGCATGGCGGCCGACGCGCTGGGCTACGTCTTGCTGGCGTTCGCGACGC
GAGGCTGGATGGCCTTCCCCATTATGATTCTTCTCGCTTCCGGCGGCATCGGGA

TGCCCGCGTTGCAGGCCATGCTGTCCAGGCAGGTAGATGACGACCATCAGGGA
CAGCTTCAAGGATCGCTCGCGGCTCTTACCAGCCTAACTTCGATCATTGGACCG
CTGATCGTCACGGCGATTTATGCCGCCTCGGCGAGCACATGGAACGGGTTGGC
ATGGATTGTAGGCGCCGCCCTATACCTTGTCTGCCTCCCCGCGTTGCGTCGCG
GTGCATGGAGCCGGGCCACCTCGACCTGAATGGAAGCCGGCGGCACCTCGCT
AACGGATTCACCACTCCAAGAATTGGAGCCAATCAATTCTTGCGGAGAACTGTG
AATGCGCAAACCAACCCTTGGCAGAACATATCCATCGCGTCCGCCATCTCCAGC
AGCCGCACGCGGCGCATCTCGGGCAGCGTTGGGTCCTGGCCACGGGTGCGCA
TGATCGTGCTCCTGTCGTTGAGGACCCGGCTAGGCTGGCGGGGTTGCCTTACT
GGTTAGCAGAATGAATCACCGATACGCGAGCGAACGTGAAGCGACTGCTGCTG
CAAAACGTCTGCGACCTGAGCAACAACATGAATGGTCTTCGGTTTCCGTGTTTC
GTAAAGTCTGGAAACGCGGAAGTCCCCTACGTGCTGCTGAAGTTGCCCGCAAC
AGAGAGTGGAACCAACCGGTGATACCACGATACTATGACTGAGAGTCAACGCC
ATGAGCGGCCTCATTTCTTATTCTGAGTTACAACAGTCCGCACCGCTGTCCGGT
AGCTCCTTCCGGTGGGCGCGGGGCATGACTATCGTCGCCGCACTTATGACTGT
CTTCTTTATCATGCAACTCGTAGGACAGGTGCCGGCAGCGCCCAACAGTCCCCC
GGCCACGGGGCCTGCCACCATACCCACGCCGAAACAAGCGCCCTGCACCATTA
TGTTCCGGATCTGCATCGCAGGATGCTGCTGGCTACCCTGTGGAACACCTACAT
CTGTATTAACGAAGCGCTAACCGTTTTTATCAGGCTCTGGGAGGCAGAATAAAT
GATCATATCGTCAATTATTACCTCCACGGGGAGAGCCTGAGCAAACTGGCCTCA
GGCATTTGAGAAGCACACGGTCACACTGCTTCCGGTAGTCAATAAACCGGTAAA
CCAGCAATAGACATAAGCGGCTATTTAACGACCCTGCCCTGAACCGACGACCG
GGTCGAATTTGCTTTCGAATTTCTGCCATTCATCCGCTTATTATCACTTATTCAGG
CGTAGCACCAGGCGTTTAAGGGCACCAATAACTGCCTTAAAAAAATTACGCCCC
GCCCTGCCACTCATCGCAGTACTGTTGTAATTCATTAAGCATTCTGCCGACATG
GAAGCCATCACAGACGGCATGATGAACCTGAATCGCCAGCGGCATCAGCACCT
TGTCGCCTTGCGTATAATATTTGCCCATGGTGAAAACGGGGGCGAAGAAGTTGT
CCATATTGGCCACGTTTAAATCAAAACTGGTGAAACTCACCCAGGGATTGGCTG
AGACGAAAAACATATTCTCAATAAACCCTTTAGGGAAATAGGCCAGGTTTTCACC
GTAACACGCCACATCTTGCGAATATATGTGTAGAAACTGCCGGAAATCGTCGTG
GTATTCACTCCAGAGCGATGAAAACGTTTCAGTTTGCTCATGGAAAACGGTGTA
ACAAGGGTGAACACTATCCCATATCACCAGCTCACCGTCTTTCATTGCCATACG

pRC2303

GAATTCCGGATGAGCATTCATCAGGCGGGCAAGAATGTGAATAAAGGCCGGAT
AAAACTTGTGCTTATTTTTCTTTACGGTCTTTAAAAAGGCCGTAATATCCAGCTGA
ACGGTCTGGTTATAGGTACATTGAGCAACTGACTGAAATGCCTCAAAATGTTCTT
TACGATGCCATTGGGATATATCAACGGTGGTATATCCAGTGATTTTTTTCTCCAT
TTTAGCTTCCTTAGCTCCTGAAAATCTCGATAACTCAAAAAATACGCCCGGTAGT
GATCTTATTTCATTATGGTGAAAGTTGGAACCTCTTACGTGCCGATCAACGTCTC
ATTTTCGCCAAAAGTTGGCCCAGGGCTTCCCGGTATCAACAGGGACACCAGGAT
TTATTTATTCTGCGAAGTGATCTTCCGTCACAGGTATTTATTCGGCGCAAAGTGC
GTCGGGTGATGCTGCCAACTTACTGATTTAGTGTATGATGGTGTTTTTGAGGTG

CTCCAGTGGCTTCTGTTTCTATCAGCTGTCCCTCCTGTTCAGCTACTGACGGGG
TGGTGCGTAACGGCAAAAGCACCGCCGGACATCAGCGCTAGCGGAGTGTATAC
TGGCTTACTATGTTGGCACTGATGAGGGTGTCAGTGAAGTGCTTCATGTGGCAG
GAGAAAAAAGGCTGCACCGGTGCGTCAGCAGAATATGTGATACAGGATATATTC
CGCTTCCTCGCTCACTGACTCGCTACGCTCGGTCGTTCGACTGCGGCGAGCGG
AAATGGCTTACGAACGGGGCGGAGATTTCCTGGAAGATGCCAGGAAGATACTTA
ACAGGGAAGTGAGAGGGCCGCGGCAAAGCCGTTTTTCCATAGGCTCCGCCCCC
CTGACAAGCATCACGAAATCTGACGCTCAAATCAGTGGTGGCGAAACCCGACA
GGACTATAAAGATACCAGGCGTTTCCCCCTGGCGGCTCCCTCGTGCGCTCTCCT
GTTCCTGCCTTTCGGTTTACCGGTGTCATTCCGCTGTTATGGCCGCGTTTGTCT
CATTCCACGCCTGACACTCAGTTCCGGGTAGGCAGTTCGCTCCAAGCTGGACT
GTATGCACGAACCCCCCGTTCAGTCCGACCGCTGCGCCTTATCCGGTAACTATC
GTCTTGAGTCCAACCCGGAAAGACATGCAAAAGCACCACTGGCAGCAGCCACT
GGTAATTGATTTAGAGGAGTTAGTCTTGAAGTCATGCGCCGGTTAAGGCTAAAC
TGAAAGGACAAGTTTTGGTGACTGCGCTCCTCCAAGCCAGTTACCTCGGTTCAA
AGAGTTGGTAGCTCAGAGAACCTTCGAAAAACCGCCCTGCAAGGCGGTTTTTTC
GTTTTCAGAGCAAGAGATTACGCGCAGACCAAAACGATCTCAAGAAGATCATCT
TATTAATCAGATAAAATATTTCTAGATTTCAGTGCAATTTATCTCTTCAAATGTAG
CACCTGAAGTCAGCCCCATACGATATAAGTTGTAATTCTCATGTTTGACAGCTTA
TCATCGATAAGCTTTAATGCGGTAGTTTATCACAGTTAAATTGCTAACGCAGTCA
GGCACCGTGTATGAAATCTAACAATGCGCTCATCGTCATCCTCGGCACCGTCAC
CCTGGATGCTGTAGGCATAGGCTTGGTTATGCCGGTACTGCCGGGCCTCTTGC
GGGATTACGAAATCATCCTGTGGAGCTTAGTAGGTTTAGCAAGATGGCAGCGCC
TAAATGTAGAATGATAAAAGGATTAAGAGATTAATTTCCCTAAAAATGATAAAACA
AGCGTTTTGAAAGCGCTTGTTTTTTTGGTTTGCAGTCAGAGTAGAATAGAAGTAT
CAAAAAAAGCACCGACTCGGTGCCACTTTTTCAAGTTGATAACGGACTAGCCTT
ATTTTAACTTGCTATGCTGTTTTGAATGGTTCCAACAAGATTATTTTATAACTTTTA
TAACAAATAATCAAGGAGAAATTCAAAGAAATTTATCAGCCATAAAACAATACTTA
ATACTATAGAATGATAACAAAATAAACTACTTTTTAAAAGAATTTTGTGTTATAATC
TATTTATTATTAAGTATTGGGTAATATTTTTTGAAGAGATATTTTGAAAAAGAAAAA
TTAAAGCATATTAAACTAATTTCGGAGGTCATTAAAACTATTATTGAAATCATCAA
ACTCATTATGGATTTAATTTAAACTTTTTATTTTAGGAGGCAAAAATGGATAAGAA
ATACTCAATAGGCTTAGCTATCGGCACAAATAGCGTCGGATGGGCGGTGATCAC
TGATGAATATAAGGTTCCGTCTAAAAAGTTCAAGGTTCTGGGAAATACAGACCG
CCACAGTATCAAAAAAAATCTTATAGGGGCTCTTTTATTTGACAGTGGAGAGACA
GCGGAAGCGACTCGTCTCAAACGGACAGCTCGTAGAAGGTATACACGTCGGAA
GAATCGTATTTGTTATCTACAGGAGATTTTTTCAAATGAGATGGCGAAAGTAGAT
GATAGTTTCTTTCATCGACTTGAAGAGTCTTTTTTGGTGGAAGAAGACAAGAAGC
ATGAACGTCATCCTATTTTTGGAAATATAGTAGATGAAGTTGCTTATCATGAGAA
ATATCCAACTATCTATCATCTGCGAAAAAAATTGGTAGATTCTACTGATAAAGCG
GATTTGCGCTTAATCTATTTGGCCTTAGCGCATATGATTAAGTTTCGTGGTCATT
TTTTGATTGAGGGAGATTTAAATCCTGATAATAGTGATGTGGACAAACTATTTAT
CCAGTTGGTACAAACCTACAATCAATTATTTGAAGAAAACCCTATTAACGCAAGT
GGAGTAGATGCTAAAGCGATTCTTTCTGCACGATTGAGTAAATCAAGACGATTA

GAAAATCTCATTGCTCAGCTCCCCGGTGAGAAGAAAAATGGCTTATTTGGGAAT
CTCATTGCTTTGTCATTGGGTTTGACCCCTAATTTTAAATCAAATTTTGATTTGGC
AGAAGATGCTAAATTACAGCTTTCAAAAGATACTTACGATGATGATTTAGATAATT
TATTGGCGCAAATTGGAGATCAATATGCTGATTTGTTTTTGGCAGCTAAGAATTT
ATCAGATGCTATTTTACTTTCAGATATCCTAAGAGTAAATACTGAAATAACTAAGG
CTCCCCTATCAGCTTCAATGATTAAACGCTACGATGAACATCATCAAGACTTGAC
TCTTTTAAAAGCTTTAGTTCGACAACAACTTCCAGAAAAGTATAAAGAAATCTTTT
TTGATCAATCAAAAAACGGATATGCAGGTTATATTGATGGGGGAGCTAGCCAAG
AAGAATTTTATAAATTTATCAAACCAATTTTAGAAAAAATGGATGGTACTGAGGAA
TTATTGGTGAAACTAAATCGTGAAGATTTGCTGCGCAAGCAACGGACCTTTGAC
AACGGCTCTATTCCCCATCAAATTCACTTGGGTGAGCTGCATGCTATTTTGAGAA
GACAAGAAGACTTTTATCCATTTTTAAAAGACAATCGTGAGAAGATTGAAAAAAT
CTTGACTTTTCGAATTCCTTATTATGTTGGTCCATTGGCGCGTGGCAATAGTCGT
TTTGCATGGATGACTCGGAAGTCTGAAGAAACAATTACCCCATGGAATTTTGAAG
AAGTTGTCGATAAAGGTGCTTCAGCTCAATCATTTATTGAACGCATGACAAACTT
TGATAAAAATCTTCCAAATGAAAAAGTACTACCAAAACATAGTTTGCTTTATGAGT
ATTTTACGGTTTATAACGAATTGACAAAGGTCAAATATGTTACTGAAGGAATGCG
AAAACCAGCATTTCTTTCAGGTGAACAGAAGAAAGCCATTGTTGATTTACTCTTC
AAAACAAATCGAAAAGTAACCGTTAAGCAATTAAAAGAAGATTATTTCAAAAAAAT
AGAATGTTTTGATAGTGTTGAAATTTCAGGAGTTGAAGATAGATTTAATGCTTCAT
TAGGTACCTACCATGATTTGCTAAAAATTATTAAAGATAAAGATTTTTTGGATAAT
GAAGAAAATGAAGATATCTTAGAGGATATTGTTTTAACATTGACCTTATTTGAAGA
TAGGGAGATGATTGAGGAAAGACTTAAAACATATGCTCACCTCTTTGATGATAAG
GTGATGAAACAGCTTAAACGTCGCCGTTATACTGGTTGGGGACGTTTGTCTCGA
AAATTGATTAATGGTATTAGGGATAAGCAATCTGGCAAAACAATATTAGATTTTTT
GAAATCAGATGGTTTTGCCAATCGCAATTTTATGCAGCTGATCCATGATGATAGT
TTGACATTTAAAGAAGACATTCAAAAAGCACAAGTGTCTGGACAAGGCGATAGTT
TACATGAACATATTGCAAATTTAGCTGGTAGCCCTGCTATTAAAAAAGGTATTTTA
CAGACTGTAAAAGTTGTTGATGAATTGGTCAAAGTAATGGGGCGGCATAAGCCA
GAAAATATCGTTATTGAAATGGCACGTGAAAATCAGACAACTCAAAAGGGCCAG
AAAAATTCGCGAGAGCGTATGAAACGAATCGAAGAAGGTATCAAAGAATTAGGA
AGTCAGATTCTTAAAGAGCATCCTGTTGAAAATACTCAATTGCAAAATGAAAAGC
TCTATCTCTATTATCTCCAAAATGGAAGAGACATGTATGTGGACCAAGAATTAGA
TATTAATCGTTTAAGTGATTATGATGTCGATGCCATTGTTCCACAAAGTTTCCTTA
AAGACGATTCAATAGACAATAAGGTCTTAACGCGTTCTGATAAAAATCGTGGTAA
ATCGGATAACGTTCCAAGTGAAGAAGTAGTCAAAAAGATGAAAAACTATTGGAG
ACAACTTCTAAACGCCAAGTTAATCACTCAACGTAAGTTTGATAATTTAACGAAA
GCTGAACGTGGAGGTTTGAGTGAACTTGATAAAGCTGGTTTTATCAAACGCCAA
TTGGTTGAAACTCGCCAAATCACTAAGCATGTGGCACAAATTTTGGATAGTCGCA
TGAATACTAAATACGATGAAAATGATAAACTTATTCGAGAGGTTAAAGTGATTAC
CTTAAAATCTAAATTAGTTTCTGACTTCCGAAAAGATTTCCAATTCTATAAAGTAC
GTGAGATTAACAATTACCATCATGCCCATGATGCGTATCTAAATGCCGTCGTTGG
AACTGCTTTGATTAAGAAATATCCAAAACTTGAATCGGAGTTTGTCTATGGTGAT
TATAAAGTTTATGATGTTCGTAAAATGATTGCTAAGTCTGAGCAAGAAATAGGCA

AAGCAACCGCAAAATATTTCTTTTACTCTAATATCATGAACTTCTTCAAAACAGAA
ATTACACTTGCAAATGGAGAGATTCGCAAACGCCCTCTAATCGAAACTAATGGG
GAAACTGGAGAAATTGTCTGGGATAAAGGGCGAGATTTTGCCACAGTGCGCAAA
GTATTGTCCATGCCCCAAGTCAATATTGTCAAGAAAACAGAAGTACAGACAGGC
GGATTCTCCAAGGAGTCAATTTTACCAAAAAGAAATTCGGACAAGCTTATTGCTC
GTAAAAAAGACTGGGATCCAAAAAAATATGGTGGTTTTGATAGTCCAACGGTAG
CTTATTCAGTCCTAGTGGTTGCTAAGGTGGAAAAAGGGAAATCGAAGAAGTTAA
AATCCGTTAAAGAGTTACTAGGGATCACAATTATGGAAAGAAGTTCCTTTGAAAA
AAATCCGATTGACTTTTTAGAAGCTAAAGGATATAAGGAAGTTAAAAAAGACTTA
ATCATTAAACTACCTAAATATAGTCTTTTTGAGTTAGAAAACGGTCGTAAACGGA
TGCTGGCTAGTGCCGGAGAATTACAAAAAGGAAATGAGCTGGCTCTGCCAAGC
AAATATGTGAATTTTTTATATTTAGCTAGTCATTATGAAAAGTTGAAGGGTAGTCC
AGAAGATAACGAACAAAAACAATTGTTTGTGGAGCAGCATAAGCATTATTTAGAT
GAGATTATTGAGCAAATCAGTGAATTTTCTAAGCGTGTTATTTTAGCAGATGCCA
ATTTAGATAAAGTTCTTAGTGCATATAACAAACATAGAGACAAACCAATACGTGA
ACAAGCAGAAAATATTATTCATTTATTTACGTTGACGAATCTTGGAGCTCCCGCT
GCTTTTAAATATTTTGATACAACAATTGATCGTAAACGATATACGTCTACAAAAGA
AGTTTTAGATGCCACTCTTATCCATCAATCCATCACTGGTCTTTATGAAACACGC
ATTGATTTGAGTCAGCTAGGAGGTCCTAGGGGAGGTGGCTCAGAAGGTGGCGG
ATCTGAAGGTGGCTCTGGAactagtATGAGCGATAAAATTATTCACCTGACTGACG
ACAGTTTTGACACGGATGTACTCAAAGCGGACGGGGCGATCCTCGTCGATTTCT
GGGCAGAGTGGTGCGGTCCGTGCAAAATGATCGCCCCGATTCTGGATGAAATC
GCTGACGAATATCAGGGCAAACTGACCGTTGCAAAACTGAACATCGATCAAAAC
CCTGGCACTGCGCCGAAATATGGCATCCGTGGTATCCCGACTCTGCTGCTGTTC
AAAAACGGTGAAGTGGCGGCAACCAAAGTGGGTGCACTGTCTAAAGGTCAGTT
GAAAGAGTTCCTCGACGCTAACCTGGCCGGTTCTGGTTCTGGCCATATGCACCA
TCATCATCATCATTCTTCTGGTCTGGTGCCACGCGGTTCTGGTATGAAAGAAAC
CGCTGCTGCTAAATTCGAACGCCAGCACATGGACAGCCCAGATCTGGGTACCG
ACGACGACGACAAGGCCATGGCTGATATCggatccCATATGGAAATGATGCTCGAT
AAGAAACAGATTCGTGCGATCTTTCTCTTTGAGTTTAAAATGGGTCGCAAAGCG
GCGGAGACGACGCGTAATATTAACAACGCGTTCGGTCCTGGCACCGCGAACGA
GCGTACCGTGCAATGGTGGTTCAAAAAGTTTCGCAAAGGCGACGAATCTCTGGA
GGACGAAGAGCGTTCTGGCCGCCCGTCCGAGGTTGACAACGACCAGCTGCGTG
CAATCATCGAAGCTGATCCGCTGACTACCACCCGCGAAGTTGCTGAAGAACTGA
ATGTGGATCACTCTACTGTGGTTCGCCACCTGAAACAGATCGGTAAAGTAAAAA
AACTGGACAAATGGGTTCCTCATGAACTGTCTGAAAACCAGAAAAACCGTCGTT
TCGAAGTTAGCTCCTCTCTGATTCTGCGTAACAACAACGAACCGTTCCTGGATC
GTATCGTAACCTGTGATGAGAAATGGATTCTGTATGATAACCGTCGCCGCTCTG
CTCAGTGGCTGGATCGCGAAGAAGCTCCAAAACACTTCCCGAAACCGAATCTGC
ACCAGAAGAAAGTCATGGTAACCGTATGGTGGTCTGCCGCAGGTGTTATCCACT
ATTCCTTCCTGAACCCGGGCGAAACTATCACCAGCGAAAAATACTGCCAGCAGA
TTGACGAAATGCACCGTAAACTGCAGCGTCTGCAGCCAGCACTGGTGAATCGTA
AAGGTCCGATCCTGCTGCATGATAACGCCCGTCCGCACGTTGCCCAACCGACC
CTGCAGAAACTGAACGAACTGGGCTATGAAGTTCTGCCACACCCGCCGTACTCC

CCGGATCTGTCCCCGACTGACTACCATTTCTTCAAGCATCTGGACAACTTCCTG
CAGGGTAAACGTTTTCACAACCAACAGGACGCAGAAAACGCTTTCCAGGAGTTC
GTCGAAAGCCGTTCCACTGACTTCTACGCGACCGGTATCAACAAGCTGATCAGC
CGTTGGCAGAAATGCGTGGACTGTAACGGCAGCTACTTCGATTAAGACGTCTTA
ATAACTAAAAATATGGTATAATACTCTTAATAAATGCAGTAATACAGGGGCTTTTC
AAGACTGAAGTCTAGCTGAGACAAATAGTGCGATTACGAAATTTTTTAGACAAAA
ATAGTCTACGAGGTTTTAGAGCTATGCTGTTTTGAATGGTCCCAAAACTGAGACC
AGTCTCGGAAGCTCAAAGGTCTCGTTTTAGAGCTATGCTGTTTTGAATGGTCCC
AAAACTTCAGCACACTGAGACTTGTTGAGTTCCATGTTTTAGAGCTATGCTGTTT
TGAATGGACTCCATTCAACATTGCCGATGATAACTTGAGAAAGAGGGTTAATACC
AGCAGTCGGATACCTTCCTATTCTTTCTGTTAAAGCGTTTTCATGTTATAATAGG
CAAAAGAAGAGTAGTGTGATCGTCCATTCCGACAGCATCGCCAGTCACTATGGC
GTGCTGCTAGCGCTATATGCGTTGATGCAATTTCTATGCGCACCCGTTCTCGGA
GCACTGTCCGACCGCTTTGGCCGCCGCCCAGTCCTGCTCGCTTCGCTACTTGG
AGCCACTATCGACTACGCGATCATGGCGACCACACCCGTCCTGTGGATCCTCTA
CGCCGGACGCATCGTGGCCGGCATCACCGGCGCCACAGGTGCGGTTGCTGGC
GCCTATATCGCCGACATCACCGATGGGGAAGATCGGGCTCGCCACTTCGGGCT
CATGAGCGCTTGTTTCGGCGTGGGTATGGTGGCAGGCCCCGTGGCCGGGGGA
CTGTTGGGCGCCATCTCCTTGCATGCACCATTCCTTGCGGCGGCGGTGCTCAA
CGGCCTCAACCTACTACTGGGCTGCTTCCTAATGCAGGAGTCGCATAAGGGAG
AGCGTCGACCGATGCCCTTGAGAGCCTTCAACCCAGTCAGCTCCTTCCGGTGG
GCGCGGGGCATGACTATCGTCGCCGCACTTATGACTGTCTTCTTTATCATGCAA
CTCGTAGGACAGGTGCCGGCAGCGCTCTGGGTCATTTTCGGCGAGGACCGCTT
TCGCTGGAGCGCGACGATGATCGGCCTGTCGCTTGCGGTATTCGGAATCTTGC
ACGCCCTCGCTCAAGCCTTCGTCACTGGTCCCGCCACCAAACGTTTCGGCGAG
AAGCAGGCCATTATCGCCGGCATGGCGGCCGACGCGCTGGGCTACGTCTTGCT
GGCGTTCGCGACGCGAGGCTGGATGGCCTTCCCCATTATGATTCTTCTCGCTTC
CGGCGGCATCGGGATGCCCGCGTTGCAGGCCATGCTGTCCAGGCAGGTAGAT
GACGACCATCAGGGACAGCTTCAAGGATCGCTCGCGGCTCTTACCAGCCTAAC
TTCGATCATTGGACCGCTGATCGTCACGGCGATTTATGCCGCCTCGGCGAGCA
CATGGAACGGGTTGGCATGGATTGTAGGCGCCGCCCTATACCTTGTCTGCCTC
CCCGCGTTGCGTCGCGGTGCATGGAGCCGGGCCACCTCGACCTGAATGGAAG
CCGGCGGCACCTCGCTAACGGATTCACCACTCCAAGAATTGGAGCCAATCAATT
CTTGCGGAGAACTGTGAATGCGCAAACCAACCCTTGGCAGAACATATCCATCGC
GTCCGCCATCTCCAGCAGCCGCACGCGGCGCATCTCGGGCAGCGTTGGGTCCT
GGCCACGGGTGCGCATGATCGTGCTCCTGTCGTTGAGGACCCGGCTAGGCTGG
CGGGGTTGCCTTACTGGTTAGCAGAATGAATCACCGATACGCGAGCGAACGTG
AAGCGACTGCTGCTGCAAAACGTCTGCGACCTGAGCAACAACATGAATGGTCTT
CGGTTTCCGTGTTTCGTAAAGTCTGGAAACGCGGAAGTCCCCTACGTGCTGCTG
AAGTTGCCCGCAACAGAGAGTGGAACCAACCGGTGATACCACGATACTATGACT
GAGAGTCAACGCCATGAGCGGCCTCATTTCTTATTCTGAGTTACAACAGTCCGC
ACCGCTGTCCGGTAGCTCCTTCCGGTGGGCGCGGGGCATGACTATCGTCGCCG
CACTTATGACTGTCTTCTTTATCATGCAACTCGTAGGACAGGTGCCGGCAGCGC
CCAACAGTCCCCCGGCCACGGGGCCTGCCACCATACCCACGCCGAAACAAGC

GCCCTGCACCATTATGTTCCGGATCTGCATCGCAGGATGCTGCTGGCTACCCTG
TGGAACACCTACATCTGTATTAACGAAGCGCTAACCGTTTTTATCAGGCTCTGG
GAGGCAGAATAAATGATCATATCGTCAATTATTACCTCCACGGGGAGAGCCTGA
GCAAACTGGCCTCAGGCATTTGAGAAGCACACGGTCACACTGCTTCCGGTAGTC
AATAAACCGGTAAACCAGCAATAGACATAAGCGGCTATTTAACGACCCTGCCCT
GAACCGACGACCGGGTCGAATTTGCTTTCGAATTTCTGCCATTCATCCGCTTATT
ATCACTTATTCAGGCGTAGCACCAGGCGTTTAAGGGCACCAATAACTGCCTTAA
AAAAATTACGCCCCGCCCTGCCACTCATCGCAGTACTGTTGTAATTCATTAAGCA
TTCTGCCGACATGGAAGCCATCACAGACGGCATGATGAACCTGAATCGCCAGC
GGCATCAGCACCTTGTCGCCTTGCGTATAATATTTGCCCATGGTGAAAACGGGG
GCGAAGAAGTTGTCCATATTGGCCACGTTTAAATCAAAACTGGTGAAACTCACC
CAGGGATTGGCTGAGACGAAAAACATATTCTCAATAAACCCTTTAGGGAAATAG
GCCAGGTTTTCACCGTAACACGCCACATCTTGCGAATATATGTGTAGAAACTGC
CGGAAATCGTCGTGGTATTCACTCCAGAGCGATGAAAACGTTTCAGTTTGCTCA
TGGAAAACGGTGTAACAAGGGTGAACACTATCCCATATCACCAGCTCACCGTCT
TTCATTGCCATACG

pRC2304

GAATTCCGGATGAGCATTCATCAGGCGGGCAAGAATGTGAATAAAGGCCGGAT
AAAACTTGTGCTTATTTTTCTTTACGGTCTTTAAAAAGGCCGTAATATCCAGCTGA
ACGGTCTGGTTATAGGTACATTGAGCAACTGACTGAAATGCCTCAAAATGTTCTT
TACGATGCCATTGGGATATATCAACGGTGGTATATCCAGTGATTTTTTTCTCCAT
TTTAGCTTCCTTAGCTCCTGAAAATCTCGATAACTCAAAAAATACGCCCGGTAGT
GATCTTATTTCATTATGGTGAAAGTTGGAACCTCTTACGTGCCGATCAACGTCTC
ATTTTCGCCAAAAGTTGGCCCAGGGCTTCCCGGTATCAACAGGGACACCAGGAT
TTATTTATTCTGCGAAGTGATCTTCCGTCACAGGTATTTATTCGGCGCAAAGTGC
GTCGGGTGATGCTGCCAACTTACTGATTTAGTGTATGATGGTGTTTTTGAGGTG
CTCCAGTGGCTTCTGTTTCTATCAGCTGTCCCTCCTGTTCAGCTACTGACGGGG
TGGTGCGTAACGGCAAAAGCACCGCCGGACATCAGCGCTAGCGGAGTGTATAC
TGGCTTACTATGTTGGCACTGATGAGGGTGTCAGTGAAGTGCTTCATGTGGCAG
GAGAAAAAAGGCTGCACCGGTGCGTCAGCAGAATATGTGATACAGGATATATTC
CGCTTCCTCGCTCACTGACTCGCTACGCTCGGTCGTTCGACTGCGGCGAGCGG
AAATGGCTTACGAACGGGGCGGAGATTTCCTGGAAGATGCCAGGAAGATACTTA
ACAGGGAAGTGAGAGGGCCGCGGCAAAGCCGTTTTTCCATAGGCTCCGCCCCC
CTGACAAGCATCACGAAATCTGACGCTCAAATCAGTGGTGGCGAAACCCGACA
GGACTATAAAGATACCAGGCGTTTCCCCCTGGCGGCTCCCTCGTGCGCTCTCCT
GTTCCTGCCTTTCGGTTTACCGGTGTCATTCCGCTGTTATGGCCGCGTTTGTCT
CATTCCACGCCTGACACTCAGTTCCGGGTAGGCAGTTCGCTCCAAGCTGGACT
GTATGCACGAACCCCCCGTTCAGTCCGACCGCTGCGCCTTATCCGGTAACTATC
GTCTTGAGTCCAACCCGGAAAGACATGCAAAAGCACCACTGGCAGCAGCCACT
GGTAATTGATTTAGAGGAGTTAGTCTTGAAGTCATGCGCCGGTTAAGGCTAAAC
TGAAAGGACAAGTTTTGGTGACTGCGCTCCTCCAAGCCAGTTACCTCGGTTCAA
AGAGTTGGTAGCTCAGAGAACCTTCGAAAAACCGCCCTGCAAGGCGGTTTTTTC

GTTTTCAGAGCAAGAGATTACGCGCAGACCAAAACGATCTCAAGAAGATCATCT
TATTAATCAGATAAAATATTTCTAGATTTCAGTGCAATTTATCTCTTCAAATGTAG
CACCTGAAGTCAGCCCCATACGATATAAGTTGTAATTCTCATGTTTGACAGCTTA
TCATCGATAAGCTTTAATGCGGTAGTTTATCACAGTTAAATTGCTAACGCAGTCA
GGCACCGTGTATGAAATCTAACAATGCGCTCATCGTCATCCTCGGCACCGTCAC
CCTGGATGCTGTAGGCATAGGCTTGGTTATGCCGGTACTGCCGGGCCTCTTGC
GGGATTACGAAATCATCCTGTGGAGCTTAGTAGGTTTAGCAAGATGGCAGCGCC
TAAATGTAGAATGATAAAAGGATTAAGAGATTAATTTCCCTAAAAATGATAAAACA
AGCGTTTTGAAAGCGCTTGTTTTTTTGGTTTGCAGTCAGAGTAGAATAGAAGTAT
CAAAAAAAGCACCGACTCGGTGCCACTTTTTCAAGTTGATAACGGACTAGCCTT
ATTTTAACTTGCTATGCTGTTTTGAATGGTTCCAACAAGATTATTTTATAACTTTTA
TAACAAATAATCAAGGAGAAATTCAAAGAAATTTATCAGCCATAAAACAATACTTA
ATACTATAGAATGATAACAAAATAAACTACTTTTTAAAAGAATTTTGTGTTATAATC
TATTTATTATTAAGTATTGGGTAATATTTTTTGAAGAGATATTTTGAAAAAGAAAAA
TTAAAGCATATTAAACTAATTTCGGAGGTCATTAAAACTATTATTGAAATCATCAA
ACTCATGCATCATATGGAAATGATGCTCGATAAGAAACAGATTCGTGCGATCTTT
CTCTTTGAGTTTAAAATGGGTCGCAAAGCGGCGGAGACGACGCGTAATATTAAC
AACGCGTTCGGTCCTGGCACCGCGAACGAGCGTACCGTGCAATGGTGGTTCAA
AAAGTTTCGCAAAGGCGACGAATCTCTGGAGGACGAAGAGCGTTCTGGCCGCC
CGTCCGAGGTTGACAACGACCAGCTGCGTGCAATCATCGAAGCTGATCCGCTG
ACTACCACCCGCGAAGTTGCTGAAGAACTGAATGTGGATCACTCTACTGTGGTT
CGCCACCTGAAACAGATCGGTAAAGTAAAAAAACTGGACAAATGGGTTCCTCAT
GAACTGTCTGAAAACCAGAAAAACCGTCGTTTCGAAGTTAGCTCCTCTCTGATTC
TGCGTAACAACAACGAACCGTTCCTGGATCGTATCGTAACCTGTGATGAGAAAT
GGATTCTGTATGATAACCGTCGCCGCTCTGCTCAGTGGCTGGATCGCGAAGAA
GCTCCAAAACACTTCCCGAAACCGAATCTGCACCAGAAGAAAGTCATGGTAACC
GTATGGTGGTCTGCCGCAGGTGTTATCCACTATTCCTTCCTGAACCCGGGCGAA
ACTATCACCAGCGAAAAATACTGCCAGCAGATTGACGAAATGCACCGTAAACTG
CAGCGTCTGCAGCCAGCACTGGTGAATCGTAAAGGTCCGATCCTGCTGCATGAT
AACGCCCGTCCGCACGTTGCCCAACCGACCCTGCAGAAACTGAACGAACTGGG
CTATGAAGTTCTGCCACACCCGCCGTACTCCCCGGATCTGTCCCCGACTGACTA
CCATTTCTTCAAGCATCTGGACAACTTCCTGCAGGGTAAACGTTTTCACAACCAA
CAGGACGCAGAAAACGCTTTCCAGGAGTTCGTCGAAAGCCGTTCCACTGACTTC
TACGCGACCGGTATCAACAAGCTGATCAGCCGTTGGCAGAAATGCGTGGACTG
TAACGGCAGCTACTTCGATtctagaGGAGGTGGCTCAGAAGGTGGCGGATCTGAA
GGTGGCTCTGGAactagtATGAGCGATAAAATTATTCACCTGACTGACGACAGTTT
TGACACGGATGTACTCAAAGCGGACGGGGCGATCCTCGTCGATTTCTGGGCAG
AGTGGTGCGGTCCGTGCAAAATGATCGCCCCGATTCTGGATGAAATCGCTGAC
GAATATCAGGGCAAACTGACCGTTGCAAAACTGAACATCGATCAAAACCCTGGC
ACTGCGCCGAAATATGGCATCCGTGGTATCCCGACTCTGCTGCTGTTCAAAAAC
GGTGAAGTGGCGGCAACCAAAGTGGGTGCACTGTCTAAAGGTCAGTTGAAAGA
GTTCCTCGACGCTAACCTGGCCGGTTCTGGTTCTGGCCATATGCACCATCATCA
TCATCATTCTTCTGGTCTGGTGCCACGCGGTTCTGGTATGAAAGAAACCGCTGC
TGCTAAATTCGAACGCCAGCACATGGACAGCCCAGATCTGGGTACCGACGACG

ACGACAAGGCCATGGCTGATATCCTCGAGATGGATAAGAAATACTCAATAGGCT
TAGCTATCGGCACAAATAGCGTCGGATGGGCGGTGATCACTGATGAATATAAGG
TTCCGTCTAAAAAGTTCAAGGTTCTGGGAAATACAGACCGCCACAGTATCAAAA
AAAATCTTATAGGGGCTCTTTTATTTGACAGTGGAGAGACAGCGGAAGCGACTC
GTCTCAAACGGACAGCTCGTAGAAGGTATACACGTCGGAAGAATCGTATTTGTT
ATCTACAGGAGATTTTTTCAAATGAGATGGCGAAAGTAGATGATAGTTTCTTTCA
TCGACTTGAAGAGTCTTTTTTGGTGGAAGAAGACAAGAAGCATGAACGTCATCC
TATTTTTGGAAATATAGTAGATGAAGTTGCTTATCATGAGAAATATCCAACTATCT
ATCATCTGCGAAAAAAATTGGTAGATTCTACTGATAAAGCGGATTTGCGCTTAAT
CTATTTGGCCTTAGCGCATATGATTAAGTTTCGTGGTCATTTTTTGATTGAGGGA
GATTTAAATCCTGATAATAGTGATGTGGACAAACTATTTATCCAGTTGGTACAAA
CCTACAATCAATTATTTGAAGAAAACCCTATTAACGCAAGTGGAGTAGATGCTAA
AGCGATTCTTTCTGCACGATTGAGTAAATCAAGACGATTAGAAAATCTCATTGCT
CAGCTCCCCGGTGAGAAGAAAAATGGCTTATTTGGGAATCTCATTGCTTTGTCAT
TGGGTTTGACCCCTAATTTTAAATCAAATTTTGATTTGGCAGAAGATGCTAAATTA
CAGCTTTCAAAAGATACTTACGATGATGATTTAGATAATTTATTGGCGCAAATTG
GAGATCAATATGCTGATTTGTTTTTGGCAGCTAAGAATTTATCAGATGCTATTTTA
CTTTCAGATATCCTAAGAGTAAATACTGAAATAACTAAGGCTCCCCTATCAGCTT
CAATGATTAAACGCTACGATGAACATCATCAAGACTTGACTCTTTTAAAAGCTTT
AGTTCGACAACAACTTCCAGAAAAGTATAAAGAAATCTTTTTTGATCAATCAAAAA
ACGGATATGCAGGTTATATTGATGGGGGAGCTAGCCAAGAAGAATTTTATAAATT
TATCAAACCAATTTTAGAAAAAATGGATGGTACTGAGGAATTATTGGTGAAACTA
AATCGTGAAGATTTGCTGCGCAAGCAACGGACCTTTGACAACGGCTCTATTCCC
CATCAAATTCACTTGGGTGAGCTGCATGCTATTTTGAGAAGACAAGAAGACTTTT
ATCCATTTTTAAAAGACAATCGTGAGAAGATTGAAAAAATCTTGACTTTTCGAATT
CCTTATTATGTTGGTCCATTGGCGCGTGGCAATAGTCGTTTTGCATGGATGACT
CGGAAGTCTGAAGAAACAATTACCCCATGGAATTTTGAAGAAGTTGTCGATAAA
GGTGCTTCAGCTCAATCATTTATTGAACGCATGACAAACTTTGATAAAAATCTTC
CAAATGAAAAAGTACTACCAAAACATAGTTTGCTTTATGAGTATTTTACGGTTTAT
AACGAATTGACAAAGGTCAAATATGTTACTGAAGGAATGCGAAAACCAGCATTTC
TTTCAGGTGAACAGAAGAAAGCCATTGTTGATTTACTCTTCAAAACAAATCGAAA
AGTAACCGTTAAGCAATTAAAAGAAGATTATTTCAAAAAAATAGAATGTTTTGATA
GTGTTGAAATTTCAGGAGTTGAAGATAGATTTAATGCTTCATTAGGTACCTACCA
TGATTTGCTAAAAATTATTAAAGATAAAGATTTTTTGGATAATGAAGAAAATGAAG
ATATCTTAGAGGATATTGTTTTAACATTGACCTTATTTGAAGATAGGGAGATGATT
GAGGAAAGACTTAAAACATATGCTCACCTCTTTGATGATAAGGTGATGAAACAG
CTTAAACGTCGCCGTTATACTGGTTGGGGACGTTTGTCTCGAAAATTGATTAATG
GTATTAGGGATAAGCAATCTGGCAAAACAATATTAGATTTTTTGAAATCAGATGG
TTTTGCCAATCGCAATTTTATGCAGCTGATCCATGATGATAGTTTGACATTTAAA
GAAGACATTCAAAAAGCACAAGTGTCTGGACAAGGCGATAGTTTACATGAACAT
ATTGCAAATTTAGCTGGTAGCCCTGCTATTAAAAAAGGTATTTTACAGACTGTAA
AAGTTGTTGATGAATTGGTCAAAGTAATGGGGCGGCATAAGCCAGAAAATATCG
TTATTGAAATGGCACGTGAAAATCAGACAACTCAAAAGGGCCAGAAAAATTCGC
GAGAGCGTATGAAACGAATCGAAGAAGGTATCAAAGAATTAGGAAGTCAGATTC

TTAAAGAGCATCCTGTTGAAAATACTCAATTGCAAAATGAAAAGCTCTATCTCTAT
TATCTCCAAAATGGAAGAGACATGTATGTGGACCAAGAATTAGATATTAATCGTT
TAAGTGATTATGATGTCGATGCCATTGTTCCACAAAGTTTCCTTAAAGACGATTC
AATAGACAATAAGGTCTTAACGCGTTCTGATAAAAATCGTGGTAAATCGGATAAC
GTTCCAAGTGAAGAAGTAGTCAAAAAGATGAAAAACTATTGGAGACAACTTCTAA
ACGCCAAGTTAATCACTCAACGTAAGTTTGATAATTTAACGAAAGCTGAACGTGG
AGGTTTGAGTGAACTTGATAAAGCTGGTTTTATCAAACGCCAATTGGTTGAAACT
CGCCAAATCACTAAGCATGTGGCACAAATTTTGGATAGTCGCATGAATACTAAAT
ACGATGAAAATGATAAACTTATTCGAGAGGTTAAAGTGATTACCTTAAAATCTAA
ATTAGTTTCTGACTTCCGAAAAGATTTCCAATTCTATAAAGTACGTGAGATTAACA
ATTACCATCATGCCCATGATGCGTATCTAAATGCCGTCGTTGGAACTGCTTTGAT
TAAGAAATATCCAAAACTTGAATCGGAGTTTGTCTATGGTGATTATAAAGTTTATG
ATGTTCGTAAAATGATTGCTAAGTCTGAGCAAGAAATAGGCAAAGCAACCGCAA
AATATTTCTTTTACTCTAATATCATGAACTTCTTCAAAACAGAAATTACACTTGCA
AATGGAGAGATTCGCAAACGCCCTCTAATCGAAACTAATGGGGAAACTGGAGAA
ATTGTCTGGGATAAAGGGCGAGATTTTGCCACAGTGCGCAAAGTATTGTCCATG
CCCCAAGTCAATATTGTCAAGAAAACAGAAGTACAGACAGGCGGATTCTCCAAG
GAGTCAATTTTACCAAAAAGAAATTCGGACAAGCTTATTGCTCGTAAAAAAGACT
GGGATCCAAAAAAATATGGTGGTTTTGATAGTCCAACGGTAGCTTATTCAGTCCT
AGTGGTTGCTAAGGTGGAAAAAGGGAAATCGAAGAAGTTAAAATCCGTTAAAGA
GTTACTAGGGATCACAATTATGGAAAGAAGTTCCTTTGAAAAAAATCCGATTGAC
TTTTTAGAAGCTAAAGGATATAAGGAAGTTAAAAAAGACTTAATCATTAAACTACC
TAAATATAGTCTTTTTGAGTTAGAAAACGGTCGTAAACGGATGCTGGCTAGTGCC
GGAGAATTACAAAAAGGAAATGAGCTGGCTCTGCCAAGCAAATATGTGAATTTTT
TATATTTAGCTAGTCATTATGAAAAGTTGAAGGGTAGTCCAGAAGATAACGAACA
AAAACAATTGTTTGTGGAGCAGCATAAGCATTATTTAGATGAGATTATTGAGCAA
ATCAGTGAATTTTCTAAGCGTGTTATTTTAGCAGATGCCAATTTAGATAAAGTTCT
TAGTGCATATAACAAACATAGAGACAAACCAATACGTGAACAAGCAGAAAATATT
ATTCATTTATTTACGTTGACGAATCTTGGAGCTCCCGCTGCTTTTAAATATTTTGA
TACAACAATTGATCGTAAACGATATACGTCTACAAAAGAAGTTTTAGATGCCACT
CTTATCCATCAATCCATCACTGGTCTTTATGAAACACGCATTGATTTGAGTCAGC
TAGGAGGTGACTGAAGTATATTTTAGATGAAGATTATTTCTTAATAACTAAAAATA
TGGTATAATACTCTTAATAAATGCAGTAATACAGGGGCTTTTCAAGACTGAAGTC
TAGCTGAGACAAATAGTGCGATTACGAAATTTTTTAGACAAAAATAGTCTACGAG
GTTTTAGAGCTATGCTGTTTTGAATGGTCCCAAAACGGTTTTCCCAGTCACGACG
TTGTAAAACGAGTTTTAGAGCTATGCTGTTTTGAATGGTCCCAAAACTTCAGCAC
ACTGAGACTTGTTGAGTTCCATGTTTTAGAGCTATGCTGTTTTGAATGGACTCCA
TTCAACATTGCCGATGATAACTTGAGAAAGAGGGTTAATACCAGCAGTCGGATA
CCTTCCTATTCTTTCTGTTAAAGCGTTTTCATGTTATAATAGGCAAAAGAAGAGTA
GTGTGATCGTCCATTCCGACAGCATCGCCAGTCACTATGGCGTGCTGCTAGCG
CTATATGCGTTGATGCAATTTCTATGCGCACCCGTTCTCGGAGCACTGTCCGAC
CGCTTTGGCCGCCGCCCAGTCCTGCTCGCTTCGCTACTTGGAGCCACTATCGA
CTACGCGATCATGGCGACCACACCCGTCCTGTGGATCCTCTACGCCGGACGCA
TCGTGGCCGGCATCACCGGCGCCACAGGTGCGGTTGCTGGCGCCTATATCGCC

GACATCACCGATGGGGAAGATCGGGCTCGCCACTTCGGGCTCATGAGCGCTTG
TTTCGGCGTGGGTATGGTGGCAGGCCCCGTGGCCGGGGGACTGTTGGGCGCC
ATCTCCTTGCATGCACCATTCCTTGCGGCGGCGGTGCTCAACGGCCTCAACCTA
CTACTGGGCTGCTTCCTAATGCAGGAGTCGCATAAGGGAGAGCGTCGACCGAT
GCCCTTGAGAGCCTTCAACCCAGTCAGCTCCTTCCGGTGGGCGCGGGGCATGA
CTATCGTCGCCGCACTTATGACTGTCTTCTTTATCATGCAACTCGTAGGACAGGT
GCCGGCAGCGCTCTGGGTCATTTTCGGCGAGGACCGCTTTCGCTGGAGCGCGA
CGATGATCGGCCTGTCGCTTGCGGTATTCGGAATCTTGCACGCCCTCGCTCAAG
CCTTCGTCACTGGTCCCGCCACCAAACGTTTCGGCGAGAAGCAGGCCATTATC
GCCGGCATGGCGGCCGACGCGCTGGGCTACGTCTTGCTGGCGTTCGCGACGC
GAGGCTGGATGGCCTTCCCCATTATGATTCTTCTCGCTTCCGGCGGCATCGGGA
TGCCCGCGTTGCAGGCCATGCTGTCCAGGCAGGTAGATGACGACCATCAGGGA
CAGCTTCAAGGATCGCTCGCGGCTCTTACCAGCCTAACTTCGATCATTGGACCG
CTGATCGTCACGGCGATTTATGCCGCCTCGGCGAGCACATGGAACGGGTTGGC
ATGGATTGTAGGCGCCGCCCTATACCTTGTCTGCCTCCCCGCGTTGCGTCGCG
GTGCATGGAGCCGGGCCACCTCGACCTGAATGGAAGCCGGCGGCACCTCGCT
AACGGATTCACCACTCCAAGAATTGGAGCCAATCAATTCTTGCGGAGAACTGTG
AATGCGCAAACCAACCCTTGGCAGAACATATCCATCGCGTCCGCCATCTCCAGC
AGCCGCACGCGGCGCATCTCGGGCAGCGTTGGGTCCTGGCCACGGGTGCGCA
TGATCGTGCTCCTGTCGTTGAGGACCCGGCTAGGCTGGCGGGGTTGCCTTACT
GGTTAGCAGAATGAATCACCGATACGCGAGCGAACGTGAAGCGACTGCTGCTG
CAAAACGTCTGCGACCTGAGCAACAACATGAATGGTCTTCGGTTTCCGTGTTTC
GTAAAGTCTGGAAACGCGGAAGTCCCCTACGTGCTGCTGAAGTTGCCCGCAAC
AGAGAGTGGAACCAACCGGTGATACCACGATACTATGACTGAGAGTCAACGCC
ATGAGCGGCCTCATTTCTTATTCTGAGTTACAACAGTCCGCACCGCTGTCCGGT
AGCTCCTTCCGGTGGGCGCGGGGCATGACTATCGTCGCCGCACTTATGACTGT
CTTCTTTATCATGCAACTCGTAGGACAGGTGCCGGCAGCGCCCAACAGTCCCCC
GGCCACGGGGCCTGCCACCATACCCACGCCGAAACAAGCGCCCTGCACCATTA
TGTTCCGGATCTGCATCGCAGGATGCTGCTGGCTACCCTGTGGAACACCTACAT
CTGTATTAACGAAGCGCTAACCGTTTTTATCAGGCTCTGGGAGGCAGAATAAAT
GATCATATCGTCAATTATTACCTCCACGGGGAGAGCCTGAGCAAACTGGCCTCA
GGCATTTGAGAAGCACACGGTCACACTGCTTCCGGTAGTCAATAAACCGGTAAA
CCAGCAATAGACATAAGCGGCTATTTAACGACCCTGCCCTGAACCGACGACCG
GGTCGAATTTGCTTTCGAATTTCTGCCATTCATCCGCTTATTATCACTTATTCAGG
CGTAGCACCAGGCGTTTAAGGGCACCAATAACTGCCTTAAAAAAATTACGCCCC
GCCCTGCCACTCATCGCAGTACTGTTGTAATTCATTAAGCATTCTGCCGACATG
GAAGCCATCACAGACGGCATGATGAACCTGAATCGCCAGCGGCATCAGCACCT
TGTCGCCTTGCGTATAATATTTGCCCATGGTGAAAACGGGGGCGAAGAAGTTGT
CCATATTGGCCACGTTTAAATCAAAACTGGTGAAACTCACCCAGGGATTGGCTG
AGACGAAAAACATATTCTCAATAAACCCTTTAGGGAAATAGGCCAGGTTTTCACC
GTAACACGCCACATCTTGCGAATATATGTGTAGAAACTGCCGGAAATCGTCGTG
GTATTCACTCCAGAGCGATGAAAACGTTTCAGTTTGCTCATGGAAAACGGTGTA
ACAAGGGTGAACACTATCCCATATCACCAGCTCACCGTCTTTCATTGCCATACG

pRC2305

GAATTCCGGATGAGCATTCATCAGGCGGGCAAGAATGTGAATAAAGGCCGGAT
AAAACTTGTGCTTATTTTTCTTTACGGTCTTTAAAAAGGCCGTAATATCCAGCTGA
ACGGTCTGGTTATAGGTACATTGAGCAACTGACTGAAATGCCTCAAAATGTTCTT
TACGATGCCATTGGGATATATCAACGGTGGTATATCCAGTGATTTTTTTCTCCAT
TTTAGCTTCCTTAGCTCCTGAAAATCTCGATAACTCAAAAAATACGCCCGGTAGT
GATCTTATTTCATTATGGTGAAAGTTGGAACCTCTTACGTGCCGATCAACGTCTC
ATTTTCGCCAAAAGTTGGCCCAGGGCTTCCCGGTATCAACAGGGACACCAGGAT
TTATTTATTCTGCGAAGTGATCTTCCGTCACAGGTATTTATTCGGCGCAAAGTGC
GTCGGGTGATGCTGCCAACTTACTGATTTAGTGTATGATGGTGTTTTTGAGGTG
CTCCAGTGGCTTCTGTTTCTATCAGCTGTCCCTCCTGTTCAGCTACTGACGGGG
TGGTGCGTAACGGCAAAAGCACCGCCGGACATCAGCGCTAGCGGAGTGTATAC
TGGCTTACTATGTTGGCACTGATGAGGGTGTCAGTGAAGTGCTTCATGTGGCAG
GAGAAAAAAGGCTGCACCGGTGCGTCAGCAGAATATGTGATACAGGATATATTC
CGCTTCCTCGCTCACTGACTCGCTACGCTCGGTCGTTCGACTGCGGCGAGCGG
AAATGGCTTACGAACGGGGCGGAGATTTCCTGGAAGATGCCAGGAAGATACTTA
ACAGGGAAGTGAGAGGGCCGCGGCAAAGCCGTTTTTCCATAGGCTCCGCCCCC
CTGACAAGCATCACGAAATCTGACGCTCAAATCAGTGGTGGCGAAACCCGACA
GGACTATAAAGATACCAGGCGTTTCCCCCTGGCGGCTCCCTCGTGCGCTCTCCT
GTTCCTGCCTTTCGGTTTACCGGTGTCATTCCGCTGTTATGGCCGCGTTTGTCT
CATTCCACGCCTGACACTCAGTTCCGGGTAGGCAGTTCGCTCCAAGCTGGACT
GTATGCACGAACCCCCCGTTCAGTCCGACCGCTGCGCCTTATCCGGTAACTATC
GTCTTGAGTCCAACCCGGAAAGACATGCAAAAGCACCACTGGCAGCAGCCACT
GGTAATTGATTTAGAGGAGTTAGTCTTGAAGTCATGCGCCGGTTAAGGCTAAAC
TGAAAGGACAAGTTTTGGTGACTGCGCTCCTCCAAGCCAGTTACCTCGGTTCAA
AGAGTTGGTAGCTCAGAGAACCTTCGAAAAACCGCCCTGCAAGGCGGTTTTTTC
GTTTTCAGAGCAAGAGATTACGCGCAGACCAAAACGATCTCAAGAAGATCATCT
TATTAATCAGATAAAATATTTCTAGATTTCAGTGCAATTTATCTCTTCAAATGTAG
CACCTGAAGTCAGCCCCATACGATATAAGTTGTAATTCTCATGTTTGACAGCTTA
TCATCGATAAGCTTTAATGCGGTAGTTTATCACAGTTAAATTGCTAACGCAGTCA
GGCACCGTGTATGAAATCTAACAATGCGCTCATCGTCATCCTCGGCACCGTCAC
CCTGGATGCTGTAGGCATAGGCTTGGTTATGCCGGTACTGCCGGGCCTCTTGC
GGGATTACGAAATCATCCTGTGGAGCTTAGTAGGTTTAGCAAGATGGCAGCGCC
TAAATGTAGAATGATAAAAGGATTAAGAGATTAATTTCCCTAAAAATGATAAAACA
AGCGTTTTGAAAGCGCTTGTTTTTTTGGTTTGCAGTCAGAGTAGAATAGAAGTAT
CAAAAAAAGCACCGACTCGGTGCCACTTTTTCAAGTTGATAACGGACTAGCCTT
ATTTTAACTTGCTATGCTGTTTTGAATGGTTCCAACAAGATTATTTTATAACTTTTA
TAACAAATAATCAAGGAGAAATTCAAAGAAATTTATCAGCCATAAAACAATACTTA
ATACTATAGAATGATAACAAAATAAACTACTTTTTAAAAGAATTTTGTGTTATAATC
TATTTATTATTAAGTATTGGGTAATATTTTTTGAAGAGATATTTTGAAAAAGAAAAA
TTAAAGCATATTAAACTAATTTCGGAGGTCATTAAAACTATTATTGAAATCATCAA
ACTCATTATGGATTTAATTTAAACTTTTTATTTTAGGAGGCAAAAATGGATAAGAA
ATACTCAATAGGCTTAGCTATCGGCACAAATAGCGTCGGATGGGCGGTGATCAC
TGATGAATATAAGGTTCCGTCTAAAAAGTTCAAGGTTCTGGGAAATACAGACCG

CCACAGTATCAAAAAAAATCTTATAGGGGCTCTTTTATTTGACAGTGGAGAGACA
GCGGAAGCGACTCGTCTCAAACGGACAGCTCGTAGAAGGTATACACGTCGGAA
GAATCGTATTTGTTATCTACAGGAGATTTTTTCAAATGAGATGGCGAAAGTAGAT
GATAGTTTCTTTCATCGACTTGAAGAGTCTTTTTTGGTGGAAGAAGACAAGAAGC
ATGAACGTCATCCTATTTTTGGAAATATAGTAGATGAAGTTGCTTATCATGAGAA
ATATCCAACTATCTATCATCTGCGAAAAAAATTGGTAGATTCTACTGATAAAGCG
GATTTGCGCTTAATCTATTTGGCCTTAGCGCATATGATTAAGTTTCGTGGTCATT
TTTTGATTGAGGGAGATTTAAATCCTGATAATAGTGATGTGGACAAACTATTTAT
CCAGTTGGTACAAACCTACAATCAATTATTTGAAGAAAACCCTATTAACGCAAGT
GGAGTAGATGCTAAAGCGATTCTTTCTGCACGATTGAGTAAATCAAGACGATTA
GAAAATCTCATTGCTCAGCTCCCCGGTGAGAAGAAAAATGGCTTATTTGGGAAT
CTCATTGCTTTGTCATTGGGTTTGACCCCTAATTTTAAATCAAATTTTGATTTGGC
AGAAGATGCTAAATTACAGCTTTCAAAAGATACTTACGATGATGATTTAGATAATT
TATTGGCGCAAATTGGAGATCAATATGCTGATTTGTTTTTGGCAGCTAAGAATTT
ATCAGATGCTATTTTACTTTCAGATATCCTAAGAGTAAATACTGAAATAACTAAGG
CTCCCCTATCAGCTTCAATGATTAAACGCTACGATGAACATCATCAAGACTTGAC
TCTTTTAAAAGCTTTAGTTCGACAACAACTTCCAGAAAAGTATAAAGAAATCTTTT
TTGATCAATCAAAAAACGGATATGCAGGTTATATTGATGGGGGAGCTAGCCAAG
AAGAATTTTATAAATTTATCAAACCAATTTTAGAAAAAATGGATGGTACTGAGGAA
TTATTGGTGAAACTAAATCGTGAAGATTTGCTGCGCAAGCAACGGACCTTTGAC
AACGGCTCTATTCCCCATCAAATTCACTTGGGTGAGCTGCATGCTATTTTGAGAA
GACAAGAAGACTTTTATCCATTTTTAAAAGACAATCGTGAGAAGATTGAAAAAAT
CTTGACTTTTCGAATTCCTTATTATGTTGGTCCATTGGCGCGTGGCAATAGTCGT
TTTGCATGGATGACTCGGAAGTCTGAAGAAACAATTACCCCATGGAATTTTGAAG
AAGTTGTCGATAAAGGTGCTTCAGCTCAATCATTTATTGAACGCATGACAAACTT
TGATAAAAATCTTCCAAATGAAAAAGTACTACCAAAACATAGTTTGCTTTATGAGT
ATTTTACGGTTTATAACGAATTGACAAAGGTCAAATATGTTACTGAAGGAATGCG
AAAACCAGCATTTCTTTCAGGTGAACAGAAGAAAGCCATTGTTGATTTACTCTTC
AAAACAAATCGAAAAGTAACCGTTAAGCAATTAAAAGAAGATTATTTCAAAAAAAT
AGAATGTTTTGATAGTGTTGAAATTTCAGGAGTTGAAGATAGATTTAATGCTTCAT
TAGGTACCTACCATGATTTGCTAAAAATTATTAAAGATAAAGATTTTTTGGATAAT
GAAGAAAATGAAGATATCTTAGAGGATATTGTTTTAACATTGACCTTATTTGAAGA
TAGGGAGATGATTGAGGAAAGACTTAAAACATATGCTCACCTCTTTGATGATAAG
GTGATGAAACAGCTTAAACGTCGCCGTTATACTGGTTGGGGACGTTTGTCTCGA
AAATTGATTAATGGTATTAGGGATAAGCAATCTGGCAAAACAATATTAGATTTTTT
GAAATCAGATGGTTTTGCCAATCGCAATTTTATGCAGCTGATCCATGATGATAGT
TTGACATTTAAAGAAGACATTCAAAAAGCACAAGTGTCTGGACAAGGCGATAGTT
TACATGAACATATTGCAAATTTAGCTGGTAGCCCTGCTATTAAAAAAGGTATTTTA
CAGACTGTAAAAGTTGTTGATGAATTGGTCAAAGTAATGGGGCGGCATAAGCCA
GAAAATATCGTTATTGAAATGGCACGTGAAAATCAGACAACTCAAAAGGGCCAG
AAAAATTCGCGAGAGCGTATGAAACGAATCGAAGAAGGTATCAAAGAATTAGGA
AGTCAGATTCTTAAAGAGCATCCTGTTGAAAATACTCAATTGCAAAATGAAAAGC
TCTATCTCTATTATCTCCAAAATGGAAGAGACATGTATGTGGACCAAGAATTAGA
TATTAATCGTTTAAGTGATTATGATGTCGATGCCATTGTTCCACAAAGTTTCCTTA

AAGACGATTCAATAGACAATAAGGTCTTAACGCGTTCTGATAAAAATCGTGGTAA
ATCGGATAACGTTCCAAGTGAAGAAGTAGTCAAAAAGATGAAAAACTATTGGAG
ACAACTTCTAAACGCCAAGTTAATCACTCAACGTAAGTTTGATAATTTAACGAAA
GCTGAACGTGGAGGTTTGAGTGAACTTGATAAAGCTGGTTTTATCAAACGCCAA
TTGGTTGAAACTCGCCAAATCACTAAGCATGTGGCACAAATTTTGGATAGTCGCA
TGAATACTAAATACGATGAAAATGATAAACTTATTCGAGAGGTTAAAGTGATTAC
CTTAAAATCTAAATTAGTTTCTGACTTCCGAAAAGATTTCCAATTCTATAAAGTAC
GTGAGATTAACAATTACCATCATGCCCATGATGCGTATCTAAATGCCGTCGTTGG
AACTGCTTTGATTAAGAAATATCCAAAACTTGAATCGGAGTTTGTCTATGGTGAT
TATAAAGTTTATGATGTTCGTAAAATGATTGCTAAGTCTGAGCAAGAAATAGGCA
AAGCAACCGCAAAATATTTCTTTTACTCTAATATCATGAACTTCTTCAAAACAGAA
ATTACACTTGCAAATGGAGAGATTCGCAAACGCCCTCTAATCGAAACTAATGGG
GAAACTGGAGAAATTGTCTGGGATAAAGGGCGAGATTTTGCCACAGTGCGCAAA
GTATTGTCCATGCCCCAAGTCAATATTGTCAAGAAAACAGAAGTACAGACAGGC
GGATTCTCCAAGGAGTCAATTTTACCAAAAAGAAATTCGGACAAGCTTATTGCTC
GTAAAAAAGACTGGGATCCAAAAAAATATGGTGGTTTTGATAGTCCAACGGTAG
CTTATTCAGTCCTAGTGGTTGCTAAGGTGGAAAAAGGGAAATCGAAGAAGTTAA
AATCCGTTAAAGAGTTACTAGGGATCACAATTATGGAAAGAAGTTCCTTTGAAAA
AAATCCGATTGACTTTTTAGAAGCTAAAGGATATAAGGAAGTTAAAAAAGACTTA
ATCATTAAACTACCTAAATATAGTCTTTTTGAGTTAGAAAACGGTCGTAAACGGA
TGCTGGCTAGTGCCGGAGAATTACAAAAAGGAAATGAGCTGGCTCTGCCAAGC
AAATATGTGAATTTTTTATATTTAGCTAGTCATTATGAAAAGTTGAAGGGTAGTCC
AGAAGATAACGAACAAAAACAATTGTTTGTGGAGCAGCATAAGCATTATTTAGAT
GAGATTATTGAGCAAATCAGTGAATTTTCTAAGCGTGTTATTTTAGCAGATGCCA
ATTTAGATAAAGTTCTTAGTGCATATAACAAACATAGAGACAAACCAATACGTGA
ACAAGCAGAAAATATTATTCATTTATTTACGTTGACGAATCTTGGAGCTCCCGCT
GCTTTTAAATATTTTGATACAACAATTGATCGTAAACGATATACGTCTACAAAAGA
AGTTTTAGATGCCACTCTTATCCATCAATCCATCACTGGTCTTTATGAAACACGC
ATTGATTTGAGTCAGCTAGGAGGTCCTAGGGGAGGTGGCTCAGAAGGTGGCGG
ATCTGAAGGTGGCTCTGGAactagtATGAGCGATAAAATTATTCACCTGACTGACG
ACAGTTTTGACACGGATGTACTCAAAGCGGACGGGGCGATCCTCGTCGATTTCT
GGGCAGAGTGGTGCGGTCCGTGCAAAATGATCGCCCCGATTCTGGATGAAATC
GCTGACGAATATCAGGGCAAACTGACCGTTGCAAAACTGAACATCGATCAAAAC
CCTGGCACTGCGCCGAAATATGGCATCCGTGGTATCCCGACTCTGCTGCTGTTC
AAAAACGGTGAAGTGGCGGCAACCAAAGTGGGTGCACTGTCTAAAGGTCAGTT
GAAAGAGTTCCTCGACGCTAACCTGGCCGGTTCTGGTTCTGGCCATATGCACCA
TCATCATCATCATTCTTCTGGTCTGGTGCCACGCGGTTCTGGTATGAAAGAAAC
CGCTGCTGCTAAATTCGAACGCCAGCACATGGACAGCCCAGATCTGGGTACCG
ACGACGACGACAAGGCCATGGCTGATATCggatccCATATGGAAATGATGCTCGAT
AAGAAACAGATTCGTGCGATCTTTCTCTTTGAGTTTAAAATGGGTCGCAAAGCG
GCGGAGACGACGCGTAATATTAACAACGCGTTCGGTCCTGGCACCGCGAACGA
GCGTACCGTGCAATGGTGGTTCAAAAAGTTTCGCAAAGGCGACGAATCTCTGGA
GGACGAAGAGCGTTCTGGCCGCCCGTCCGAGGTTGACAACGACCAGCTGCGTG
CAATCATCGAAGCTGATCCGCTGACTACCACCCGCGAAGTTGCTGAAGAACTGA

ATGTGGATCACTCTACTGTGGTTCGCCACCTGAAACAGATCGGTAAAGTAAAAA
AACTGGACAAATGGGTTCCTCATGAACTGTCTGAAAACCAGAAAAACCGTCGTT
TCGAAGTTAGCTCCTCTCTGATTCTGCGTAACAACAACGAACCGTTCCTGGATC
GTATCGTAACCTGTGATGAGAAATGGATTCTGTATGATAACCGTCGCCGCTCTG
CTCAGTGGCTGGATCGCGAAGAAGCTCCAAAACACTTCCCGAAACCGAATCTGC
ACCAGAAGAAAGTCATGGTAACCGTATGGTGGTCTGCCGCAGGTGTTATCCACT
ATTCCTTCCTGAACCCGGGCGAAACTATCACCAGCGAAAAATACTGCCAGCAGA
TTGACGAAATGCACCGTAAACTGCAGCGTCTGCAGCCAGCACTGGTGAATCGTA
AAGGTCCGATCCTGCTGCATGATAACGCCCGTCCGCACGTTGCCCAACCGACC
CTGCAGAAACTGAACGAACTGGGCTATGAAGTTCTGCCACACCCGCCGTACTCC
CCGGATCTGTCCCCGACTGACTACCATTTCTTCAAGCATCTGGACAACTTCCTG
CAGGGTAAACGTTTTCACAACCAACAGGACGCAGAAAACGCTTTCCAGGAGTTC
GTCGAAAGCCGTTCCACTGACTTCTACGCGACCGGTATCAACAAGCTGATCAGC
CGTTGGCAGAAATGCGTGGACTGTAACGGCAGCTACTTCGATTAAGACGTCTTA
ATAACTAAAAATATGGTATAATACTCTTAATAAATGCAGTAATACAGGGGCTTTTC
AAGACTGAAGTCTAGCTGAGACAAATAGTGCGATTACGAAATTTTTTAGACAAAA
ATAGTCTACGAGGTTTTAGAGCTATGCTGTTTTGAATGGTCCCAAAACGGTTTTC
CCAGTCACGACGTTGTAAAACGAGTTTTAGAGCTATGCTGTTTTGAATGGTCCCA
AAACTTCAGCACACTGAGACTTGTTGAGTTCCATGTTTTAGAGCTATGCTGTTTT
GAATGGACTCCATTCAACATTGCCGATGATAACTTGAGAAAGAGGGTTAATACC
AGCAGTCGGATACCTTCCTATTCTTTCTGTTAAAGCGTTTTCATGTTATAATAGG
CAAAAGAAGAGTAGTGTGATCGTCCATTCCGACAGCATCGCCAGTCACTATGGC
GTGCTGCTAGCGCTATATGCGTTGATGCAATTTCTATGCGCACCCGTTCTCGGA
GCACTGTCCGACCGCTTTGGCCGCCGCCCAGTCCTGCTCGCTTCGCTACTTGG
AGCCACTATCGACTACGCGATCATGGCGACCACACCCGTCCTGTGGATCCTCTA
CGCCGGACGCATCGTGGCCGGCATCACCGGCGCCACAGGTGCGGTTGCTGGC
GCCTATATCGCCGACATCACCGATGGGGAAGATCGGGCTCGCCACTTCGGGCT
CATGAGCGCTTGTTTCGGCGTGGGTATGGTGGCAGGCCCCGTGGCCGGGGGA
CTGTTGGGCGCCATCTCCTTGCATGCACCATTCCTTGCGGCGGCGGTGCTCAA
CGGCCTCAACCTACTACTGGGCTGCTTCCTAATGCAGGAGTCGCATAAGGGAG
AGCGTCGACCGATGCCCTTGAGAGCCTTCAACCCAGTCAGCTCCTTCCGGTGG
GCGCGGGGCATGACTATCGTCGCCGCACTTATGACTGTCTTCTTTATCATGCAA
CTCGTAGGACAGGTGCCGGCAGCGCTCTGGGTCATTTTCGGCGAGGACCGCTT
TCGCTGGAGCGCGACGATGATCGGCCTGTCGCTTGCGGTATTCGGAATCTTGC
ACGCCCTCGCTCAAGCCTTCGTCACTGGTCCCGCCACCAAACGTTTCGGCGAG
AAGCAGGCCATTATCGCCGGCATGGCGGCCGACGCGCTGGGCTACGTCTTGCT
GGCGTTCGCGACGCGAGGCTGGATGGCCTTCCCCATTATGATTCTTCTCGCTTC
CGGCGGCATCGGGATGCCCGCGTTGCAGGCCATGCTGTCCAGGCAGGTAGAT
GACGACCATCAGGGACAGCTTCAAGGATCGCTCGCGGCTCTTACCAGCCTAAC
TTCGATCATTGGACCGCTGATCGTCACGGCGATTTATGCCGCCTCGGCGAGCA
CATGGAACGGGTTGGCATGGATTGTAGGCGCCGCCCTATACCTTGTCTGCCTC
CCCGCGTTGCGTCGCGGTGCATGGAGCCGGGCCACCTCGACCTGAATGGAAG
CCGGCGGCACCTCGCTAACGGATTCACCACTCCAAGAATTGGAGCCAATCAATT
CTTGCGGAGAACTGTGAATGCGCAAACCAACCCTTGGCAGAACATATCCATCGC

GTCCGCCATCTCCAGCAGCCGCACGCGGCGCATCTCGGGCAGCGTTGGGTCCT
GGCCACGGGTGCGCATGATCGTGCTCCTGTCGTTGAGGACCCGGCTAGGCTGG
CGGGGTTGCCTTACTGGTTAGCAGAATGAATCACCGATACGCGAGCGAACGTG
AAGCGACTGCTGCTGCAAAACGTCTGCGACCTGAGCAACAACATGAATGGTCTT
CGGTTTCCGTGTTTCGTAAAGTCTGGAAACGCGGAAGTCCCCTACGTGCTGCTG
AAGTTGCCCGCAACAGAGAGTGGAACCAACCGGTGATACCACGATACTATGACT
GAGAGTCAACGCCATGAGCGGCCTCATTTCTTATTCTGAGTTACAACAGTCCGC
ACCGCTGTCCGGTAGCTCCTTCCGGTGGGCGCGGGGCATGACTATCGTCGCCG
CACTTATGACTGTCTTCTTTATCATGCAACTCGTAGGACAGGTGCCGGCAGCGC
CCAACAGTCCCCCGGCCACGGGGCCTGCCACCATACCCACGCCGAAACAAGC
GCCCTGCACCATTATGTTCCGGATCTGCATCGCAGGATGCTGCTGGCTACCCTG
TGGAACACCTACATCTGTATTAACGAAGCGCTAACCGTTTTTATCAGGCTCTGG
GAGGCAGAATAAATGATCATATCGTCAATTATTACCTCCACGGGGAGAGCCTGA
GCAAACTGGCCTCAGGCATTTGAGAAGCACACGGTCACACTGCTTCCGGTAGTC
AATAAACCGGTAAACCAGCAATAGACATAAGCGGCTATTTAACGACCCTGCCCT
GAACCGACGACCGGGTCGAATTTGCTTTCGAATTTCTGCCATTCATCCGCTTATT
ATCACTTATTCAGGCGTAGCACCAGGCGTTTAAGGGCACCAATAACTGCCTTAA
AAAAATTACGCCCCGCCCTGCCACTCATCGCAGTACTGTTGTAATTCATTAAGCA
TTCTGCCGACATGGAAGCCATCACAGACGGCATGATGAACCTGAATCGCCAGC
GGCATCAGCACCTTGTCGCCTTGCGTATAATATTTGCCCATGGTGAAAACGGGG
GCGAAGAAGTTGTCCATATTGGCCACGTTTAAATCAAAACTGGTGAAACTCACC
CAGGGATTGGCTGAGACGAAAAACATATTCTCAATAAACCCTTTAGGGAAATAG
GCCAGGTTTTCACCGTAACACGCCACATCTTGCGAATATATGTGTAGAAACTGC
CGGAAATCGTCGTGGTATTCACTCCAGAGCGATGAAAACGTTTCAGTTTGCTCA
TGGAAAACGGTGTAACAAGGGTGAACACTATCCCATATCACCAGCTCACCGTCT
TTCATTGCCATACG

pRC2306

GAATTCCGGATGAGCATTCATCAGGCGGGCAAGAATGTGAATAAAGGCCGGAT
AAAACTTGTGCTTATTTTTCTTTACGGTCTTTAAAAAGGCCGTAATATCCAGCTGA
ACGGTCTGGTTATAGGTACATTGAGCAACTGACTGAAATGCCTCAAAATGTTCTT
TACGATGCCATTGGGATATATCAACGGTGGTATATCCAGTGATTTTTTTCTCCAT
TTTAGCTTCCTTAGCTCCTGAAAATCTCGATAACTCAAAAAATACGCCCGGTAGT
GATCTTATTTCATTATGGTGAAAGTTGGAACCTCTTACGTGCCGATCAACGTCTC
ATTTTCGCCAAAAGTTGGCCCAGGGCTTCCCGGTATCAACAGGGACACCAGGAT
TTATTTATTCTGCGAAGTGATCTTCCGTCACAGGTATTTATTCGGCGCAAAGTGC
GTCGGGTGATGCTGCCAACTTACTGATTTAGTGTATGATGGTGTTTTTGAGGTG
CTCCAGTGGCTTCTGTTTCTATCAGCTGTCCCTCCTGTTCAGCTACTGACGGGG
TGGTGCGTAACGGCAAAAGCACCGCCGGACATCAGCGCTAGCGGAGTGTATAC
TGGCTTACTATGTTGGCACTGATGAGGGTGTCAGTGAAGTGCTTCATGTGGCAG
GAGAAAAAAGGCTGCACCGGTGCGTCAGCAGAATATGTGATACAGGATATATTC
CGCTTCCTCGCTCACTGACTCGCTACGCTCGGTCGTTCGACTGCGGCGAGCGG
AAATGGCTTACGAACGGGGCGGAGATTTCCTGGAAGATGCCAGGAAGATACTTA

ACAGGGAAGTGAGAGGGCCGCGGCAAAGCCGTTTTTCCATAGGCTCCGCCCCC
CTGACAAGCATCACGAAATCTGACGCTCAAATCAGTGGTGGCGAAACCCGACA
GGACTATAAAGATACCAGGCGTTTCCCCCTGGCGGCTCCCTCGTGCGCTCTCCT
GTTCCTGCCTTTCGGTTTACCGGTGTCATTCCGCTGTTATGGCCGCGTTTGTCT
CATTCCACGCCTGACACTCAGTTCCGGGTAGGCAGTTCGCTCCAAGCTGGACT
GTATGCACGAACCCCCCGTTCAGTCCGACCGCTGCGCCTTATCCGGTAACTATC
GTCTTGAGTCCAACCCGGAAAGACATGCAAAAGCACCACTGGCAGCAGCCACT
GGTAATTGATTTAGAGGAGTTAGTCTTGAAGTCATGCGCCGGTTAAGGCTAAAC
TGAAAGGACAAGTTTTGGTGACTGCGCTCCTCCAAGCCAGTTACCTCGGTTCAA
AGAGTTGGTAGCTCAGAGAACCTTCGAAAAACCGCCCTGCAAGGCGGTTTTTTC
GTTTTCAGAGCAAGAGATTACGCGCAGACCAAAACGATCTCAAGAAGATCATCT
TATTAATCAGATAAAATATTTCTAGATTTCAGTGCAATTTATCTCTTCAAATGTAG
CACCTGAAGTCAGCCCCATACGATATAAGTTGTAATTCTCATGTTTGACAGCTTA
TCATCGATAAGCTTTAATGCGGTAGTTTATCACAGTTAAATTGCTAACGCAGTCA
GGCACCGTGTATGAAATCTAACAATGCGCTCATCGTCATCCTCGGCACCGTCAC
CCTGGATGCTGTAGGCATAGGCTTGGTTATGCCGGTACTGCCGGGCCTCTTGC
GGGATTACGAAATCATCCTGTGGAGCTTAGTAGGTTTAGCAAGATGGCAGCGCC
TAAATGTAGAATGATAAAAGGATTAAGAGATTAATTTCCCTAAAAATGATAAAACA
AGCGTTTTGAAAGCGCTTGTTTTTTTGGTTTGCAGTCAGAGTAGAATAGAAGTAT
CAAAAAAAGCACCGACTCGGTGCCACTTTTTCAAGTTGATAACGGACTAGCCTT
ATTTTAACTTGCTATGCTGTTTTGAATGGTTCCAACAAGATTATTTTATAACTTTTA
TAACAAATAATCAAGGAGAAATTCAAAGAAATTTATCAGCCATAAAACAATACTTA
ATACTATAGAATGATAACAAAATAAACTACTTTTTAAAAGAATTTTGTGTTATAATC
TATTTATTATTAAGTATTGGGTAATATTTTTTGAAGAGATATTTTGAAAAAGAAAAA
TTAAAGCATATTAAACTAATTTCGGAGGTCATTAAAACTATTATTGAAATCATCAA
ACTCATTATGGATTTAATTTAAACTTTTTATTTTAGGAGGCAACATATGGAAATGA
TGCTCGATAAGAAACAGATTCGTGCGATCTTTCTCTTTGAGTTTAAAATGGGTCG
CAAAGCGGCGGAGACGACGCGTAATATTAACAACGCGTTCGGTCCTGGCACCG
CGAACGAGCGTACCGTGCAATGGTGGTTCAAAAAGTTTCGCAAAGGCGACGAA
TCTCTGGAGGACGAAGAGCGTTCTGGCCGCCCGTCCGAGGTTGACAACGACCA
GCTGCGTGCAATCATCGAAGCTGATCCGCTGACTACCACCCGCGAAGTTGCTG
AAGAACTGAATGTGGATCACTCTACTGTGGTTCGCCACCTGAAACAGATCGGTA
AAGTAAAAAAACTGGACAAATGGGTTCCTCATGAACTGTCTGAAAACCAGAAAAA
CCGTCGTTTCGAAGTTAGCTCCTCTCTGATTCTGCGTAACAACAACGAACCGTT
CCTGGATCGTATCGTAACCTGTGATGAGAAATGGATTCTGTATGATAACCGTCG
CCGCTCTGCTCAGTGGCTGGATCGCGAAGAAGCTCCAAAACACTTCCCGAAAC
CGAATCTGCACCAGAAGAAAGTCATGGTAACCGTATGGTGGTCTGCCGCAGGT
GTTATCCACTATTCCTTCCTGAACCCGGGCGAAACTATCACCAGCGAAAAATACT
GCCAGCAGATTGACGAAATGCACCGTAAACTGCAGCGTCTGCAGCCAGCACTG
GTGAATCGTAAAGGTCCGATCCTGCTGCATGATAACGCCCGTCCGCACGTTGCC
CAACCGACCCTGCAGAAACTGAACGAACTGGGCTATGAAGTTCTGCCACACCC
GCCGTACTCCCCGGATCTGTCCCCGACTGACTACCATTTCTTCAAGCATCTGGA
CAACTTCCTGCAGGGTAAACGTTTTCACAACCAACAGGACGCAGAAAACGCTTT
CCAGGAGTTCGTCGAAAGCCGTTCCACTGACTTCTACGCGACCGGTATCAACAA

GCTGATCAGCCGTTGGCAGAAATGCGTGGACTGTAACGGCAGCTACTTCGATTA
AGGATCCTCTAGAGTCGACCGATGCCCTTGAGAGCCTTCAACCCAGTCAGCTCC
TTCCGGTGGGCGCGGGGCATGACTATCGTCGCCGCACTTATGACTGTCTTCTTT
ATCATGCAACTCGTAGGACAGGTGCCGGCAGCGCTCTGGGTCATTTTCGGCGA
GGACCGCTTTCGCTGGAGCGCGACGATGATCGGCCTGTCGCTTGCGGTATTCG
GAATCTTGCACGCCCTCGCTCAAGCCTTCGTCACTGGTCCCGCCACCAAACGTT
TCGGCGAGAAGCAGGCCATTATCGCCGGCATGGCGGCCGACGCGCTGGGCTA
CGTCTTGCTGGCGTTCGCGACGCGAGGCTGGATGGCCTTCCCCATTATGATTCT
TCTCGCTTCCGGCGGCATCGGGATGCCCGCGTTGCAGGCCATGCTGTCCAGGC
AGGTAGATGACGACCATCAGGGACAGCTTCAAGGATCGCTCGCGGCTCTTACC
AGCCTAACTTCGATCATTGGACCGCTGATCGTCACGGCGATTTATGCCGCCTCG
GCGAGCACATGGAACGGGTTGGCATGGATTGTAGGCGCCGCCCTATACCTTGT
CTGCCTCCCCGCGTTGCGTCGCGGTGCATGGAGCCGGGCCACCTCGACCTGAA
TGGAAGCCGGCGGCACCTCGCTAACGGATTCACCACTCCAAGAATTGGAGCCA
ATCAATTCTTGCGGAGAACTGTGAATGCGCAAACCAACCCTTGGCAGAACATAT
CCATCGCGTCCGCCATCTCCAGCAGCCGCACGCGGCGCATCTCGGGCAGCGTT
GGGTCCTGGCCACGGGTGCGCATGATCGTGCTCCTGTCGTTGAGGACCCGGCT
AGGCTGGCGGGGTTGCCTTACTGGTTAGCAGAATGAATCACCGATACGCGAGC
GAACGTGAAGCGACTGCTGCTGCAAAACGTCTGCGACCTGAGCAACAACATGA
ATGGTCTTCGGTTTCCGTGTTTCGTAAAGTCTGGAAACGCGGAAGTCCCCTACG
TGCTGCTGAAGTTGCCCGCAACAGAGAGTGGAACCAACCGGTGATACCACGAT
ACTATGACTGAGAGTCAACGCCATGAGCGGCCTCATTTCTTATTCTGAGTTACAA
CAGTCCGCACCGCTGTCCGGTAGCTCCTTCCGGTGGGCGCGGGGCATGACTAT
CGTCGCCGCACTTATGACTGTCTTCTTTATCATGCAACTCGTAGGACAGGTGCC
GGCAGCGCCCAACAGTCCCCCGGCCACGGGGCCTGCCACCATACCCACGCCG
AAACAAGCGCCCTGCACCATTATGTTCCGGATCTGCATCGCAGGATGCTGCTGG
CTACCCTGTGGAACACCTACATCTGTATTAACGAAGCGCTAACCGTTTTTATCAG
GCTCTGGGAGGCAGAATAAATGATCATATCGTCAATTATTACCTCCACGGGGAG
AGCCTGAGCAAACTGGCCTCAGGCATTTGAGAAGCACACGGTCACACTGCTTCC
GGTAGTCAATAAACCGGTAAACCAGCAATAGACATAAGCGGCTATTTAACGACC
CTGCCCTGAACCGACGACCGGGTCGAATTTGCTTTCGAATTTCTGCCATTCATC
CGCTTATTATCACTTATTCAGGCGTAGCACCAGGCGTTTAAGGGCACCAATAAC
TGCCTTAAAAAAATTACGCCCCGCCCTGCCACTCATCGCAGTACTGTTGTAATTC
ATTAAGCATTCTGCCGACATGGAAGCCATCACAGACGGCATGATGAACCTGAAT
CGCCAGCGGCATCAGCACCTTGTCGCCTTGCGTATAATATTTGCCCATGGTGAA
AACGGGGGCGAAGAAGTTGTCCATATTGGCCACGTTTAAATCAAAACTGGTGAA
ACTCACCCAGGGATTGGCTGAGACGAAAAACATATTCTCAATAAACCCTTTAGG
GAAATAGGCCAGGTTTTCACCGTAACACGCCACATCTTGCGAATATATGTGTAG
AAACTGCCGGAAATCGTCGTGGTATTCACTCCAGAGCGATGAAAACGTTTCAGT
TTGCTCATGGAAAACGGTGTAACAAGGGTGAACACTATCCCATATCACCAGCTC
ACCGTCTTTCATTGCCATACG

pRC2307

GAATTCCGGATGAGCATTCATCAGGCGGGCAAGAATGTGAATAAAGGCCGGAT
AAAACTTGTGCTTATTTTTCTTTACGGTCTTTAAAAAGGCCGTAATATCCAGCTGA
ACGGTCTGGTTATAGGTACATTGAGCAACTGACTGAAATGCCTCAAAATGTTCTT
TACGATGCCATTGGGATATATCAACGGTGGTATATCCAGTGATTTTTTTCTCCAT
TTTAGCTTCCTTAGCTCCTGAAAATCTCGATAACTCAAAAAATACGCCCGGTAGT
GATCTTATTTCATTATGGTGAAAGTTGGAACCTCTTACGTGCCGATCAACGTCTC
ATTTTCGCCAAAAGTTGGCCCAGGGCTTCCCGGTATCAACAGGGACACCAGGAT
TTATTTATTCTGCGAAGTGATCTTCCGTCACAGGTATTTATTCGGCGCAAAGTGC
GTCGGGTGATGCTGCCAACTTACTGATTTAGTGTATGATGGTGTTTTTGAGGTG
CTCCAGTGGCTTCTGTTTCTATCAGCTGTCCCTCCTGTTCAGCTACTGACGGGG
TGGTGCGTAACGGCAAAAGCACCGCCGGACATCAGCGCTAGCGGAGTGTATAC
TGGCTTACTATGTTGGCACTGATGAGGGTGTCAGTGAAGTGCTTCATGTGGCAG
GAGAAAAAAGGCTGCACCGGTGCGTCAGCAGAATATGTGATACAGGATATATTC
CGCTTCCTCGCTCACTGACTCGCTACGCTCGGTCGTTCGACTGCGGCGAGCGG
AAATGGCTTACGAACGGGGCGGAGATTTCCTGGAAGATGCCAGGAAGATACTTA
ACAGGGAAGTGAGAGGGCCGCGGCAAAGCCGTTTTTCCATAGGCTCCGCCCCC
CTGACAAGCATCACGAAATCTGACGCTCAAATCAGTGGTGGCGAAACCCGACA
GGACTATAAAGATACCAGGCGTTTCCCCCTGGCGGCTCCCTCGTGCGCTCTCCT
GTTCCTGCCTTTCGGTTTACCGGTGTCATTCCGCTGTTATGGCCGCGTTTGTCT
CATTCCACGCCTGACACTCAGTTCCGGGTAGGCAGTTCGCTCCAAGCTGGACT
GTATGCACGAACCCCCCGTTCAGTCCGACCGCTGCGCCTTATCCGGTAACTATC
GTCTTGAGTCCAACCCGGAAAGACATGCAAAAGCACCACTGGCAGCAGCCACT
GGTAATTGATTTAGAGGAGTTAGTCTTGAAGTCATGCGCCGGTTAAGGCTAAAC
TGAAAGGACAAGTTTTGGTGACTGCGCTCCTCCAAGCCAGTTACCTCGGTTCAA
AGAGTTGGTAGCTCAGAGAACCTTCGAAAAACCGCCCTGCAAGGCGGTTTTTTC
GTTTTCAGAGCAAGAGATTACGCGCAGACCAAAACGATCTCAAGAAGATCATCT
TATTAATCAGATAAAATATTTCTAGATTTCAGTGCAATTTATCTCTTCAAATGTAG
CACCTGAAGTCAGCCCCATACGATATAAGTTGTAATTCTCATGTTTGACAGCTTA
TCATCGATAAGCTTTAATGCGGTAGTTTATCACAGTTAAATTGCTAACGCAGTCA
GGCACCGTGTATGAAATCTAACAATGCGCTCATCGTCATCCTCGGCACCGTCAC
CCTGGATGCTGTAGGCATAGGCTTGGTTATGCCGGTACTGCCGGGCCTCTTGC
GGGATTACGAAATCATCCTGTGGAGCTTAGTAGGTTTAGCAAGATGGCAGCGCC
TAAATGTAGAATGATAAAAGGATTAAGAGATTAATTTCCCTAAAAATGATAAAACA
AGCGTTTTGAAAGCGCTTGTTTTTTTGGTTTGCAGTCAGAGTAGAATAGAAGTAT
CAAAAAAAGCACCGACTCGGTGCCACTTTTTCAAGTTGATAACGGACTAGCCTT
ATTTTAACTTGCTATGCTGTTTTGAATGGTTCCAACAAGATTATTTTATAACTTTTA
TAACAAATAATCAAGGAGAAATTCAAAGAAATTTATCAGCCATAAAACAATACTTA
ATACTATAGAATGATAACAAAATAAACTACTTTTTAAAAGAATTTTGTGTTATAATC
TATTTATTATTAAGTATTGGGTAATATTTTTTGAAGAGCGGCCGCGCACGATCTC
GACACTCGAGATGGATAAGAAATACTCAATAGGCTTAGCTATCGGCACAAATAG
CGTCGGATGGGCGGTGATCACTGATGAATATAAGGTTCCGTCTAAAAAGTTCAA
GGTTCTGGGAAATACAGACCGCCACAGTATCAAAAAAAATCTTATAGGGGCTCT
TTTATTTGACAGTGGAGAGACAGCGGAAGCGACTCGTCTCAAACGGACAGCTC
GTAGAAGGTATACACGTCGGAAGAATCGTATTTGTTATCTACAGGAGATTTTTTC

AAATGAGATGGCGAAAGTAGATGATAGTTTCTTTCATCGACTTGAAGAGTCTTTT
TTGGTGGAAGAAGACAAGAAGCATGAACGTCATCCTATTTTTGGAAATATAGTAG
ATGAAGTTGCTTATCATGAGAAATATCCAACTATCTATCATCTGCGAAAAAAATT
GGTAGATTCTACTGATAAAGCGGATTTGCGCTTAATCTATTTGGCCTTAGCGCAT
ATGATTAAGTTTCGTGGTCATTTTTTGATTGAGGGAGATTTAAATCCTGATAATAG
TGATGTGGACAAACTATTTATCCAGTTGGTACAAACCTACAATCAATTATTTGAA
GAAAACCCTATTAACGCAAGTGGAGTAGATGCTAAAGCGATTCTTTCTGCACGA
TTGAGTAAATCAAGACGATTAGAAAATCTCATTGCTCAGCTCCCCGGTGAGAAG
AAAAATGGCTTATTTGGGAATCTCATTGCTTTGTCATTGGGTTTGACCCCTAATT
TTAAATCAAATTTTGATTTGGCAGAAGATGCTAAATTACAGCTTTCAAAAGATACT
TACGATGATGATTTAGATAATTTATTGGCGCAAATTGGAGATCAATATGCTGATT
TGTTTTTGGCAGCTAAGAATTTATCAGATGCTATTTTACTTTCAGATATCCTAAGA
GTAAATACTGAAATAACTAAGGCTCCCCTATCAGCTTCAATGATTAAACGCTACG
ATGAACATCATCAAGACTTGACTCTTTTAAAAGCTTTAGTTCGACAACAACTTCC
AGAAAAGTATAAAGAAATCTTTTTTGATCAATCAAAAAACGGATATGCAGGTTAT
ATTGATGGGGGAGCTAGCCAAGAAGAATTTTATAAATTTATCAAACCAATTTTAG
AAAAAATGGATGGTACTGAGGAATTATTGGTGAAACTAAATCGTGAAGATTTGCT
GCGCAAGCAACGGACCTTTGACAACGGCTCTATTCCCCATCAAATTCACTTGGG
TGAGCTGCATGCTATTTTGAGAAGACAAGAAGACTTTTATCCATTTTTAAAAGAC
AATCGTGAGAAGATTGAAAAAATCTTGACTTTTCGAATTCCTTATTATGTTGGTCC
ATTGGCGCGTGGCAATAGTCGTTTTGCATGGATGACTCGGAAGTCTGAAGAAAC
AATTACCCCATGGAATTTTGAAGAAGTTGTCGATAAAGGTGCTTCAGCTCAATCA
TTTATTGAACGCATGACAAACTTTGATAAAAATCTTCCAAATGAAAAAGTACTACC
AAAACATAGTTTGCTTTATGAGTATTTTACGGTTTATAACGAATTGACAAAGGTCA
AATATGTTACTGAAGGAATGCGAAAACCAGCATTTCTTTCAGGTGAACAGAAGAA
AGCCATTGTTGATTTACTCTTCAAAACAAATCGAAAAGTAACCGTTAAGCAATTA
AAAGAAGATTATTTCAAAAAAATAGAATGTTTTGATAGTGTTGAAATTTCAGGAGT
TGAAGATAGATTTAATGCTTCATTAGGTACCTACCATGATTTGCTAAAAATTATTA
AAGATAAAGATTTTTTGGATAATGAAGAAAATGAAGATATCTTAGAGGATATTGTT
TTAACATTGACCTTATTTGAAGATAGGGAGATGATTGAGGAAAGACTTAAAACAT
ATGCTCACCTCTTTGATGATAAGGTGATGAAACAGCTTAAACGTCGCCGTTATAC
TGGTTGGGGACGTTTGTCTCGAAAATTGATTAATGGTATTAGGGATAAGCAATCT
GGCAAAACAATATTAGATTTTTTGAAATCAGATGGTTTTGCCAATCGCAATTTTAT
GCAGCTGATCCATGATGATAGTTTGACATTTAAAGAAGACATTCAAAAAGCACAA
GTGTCTGGACAAGGCGATAGTTTACATGAACATATTGCAAATTTAGCTGGTAGC
CCTGCTATTAAAAAAGGTATTTTACAGACTGTAAAAGTTGTTGATGAATTGGTCA
AAGTAATGGGGCGGCATAAGCCAGAAAATATCGTTATTGAAATGGCACGTGAAA
ATCAGACAACTCAAAAGGGCCAGAAAAATTCGCGAGAGCGTATGAAACGAATCG
AAGAAGGTATCAAAGAATTAGGAAGTCAGATTCTTAAAGAGCATCCTGTTGAAAA
TACTCAATTGCAAAATGAAAAGCTCTATCTCTATTATCTCCAAAATGGAAGAGAC
ATGTATGTGGACCAAGAATTAGATATTAATCGTTTAAGTGATTATGATGTCGATG
CCATTGTTCCACAAAGTTTCCTTAAAGACGATTCAATAGACAATAAGGTCTTAAC
GCGTTCTGATAAAAATCGTGGTAAATCGGATAACGTTCCAAGTGAAGAAGTAGT
CAAAAAGATGAAAAACTATTGGAGACAACTTCTAAACGCCAAGTTAATCACTCAA

CGTAAGTTTGATAATTTAACGAAAGCTGAACGTGGAGGTTTGAGTGAACTTGATA
AAGCTGGTTTTATCAAACGCCAATTGGTTGAAACTCGCCAAATCACTAAGCATGT
GGCACAAATTTTGGATAGTCGCATGAATACTAAATACGATGAAAATGATAAACTT
ATTCGAGAGGTTAAAGTGATTACCTTAAAATCTAAATTAGTTTCTGACTTCCGAAA
AGATTTCCAATTCTATAAAGTACGTGAGATTAACAATTACCATCATGCCCATGAT
GCGTATCTAAATGCCGTCGTTGGAACTGCTTTGATTAAGAAATATCCAAAACTTG
AATCGGAGTTTGTCTATGGTGATTATAAAGTTTATGATGTTCGTAAAATGATTGCT
AAGTCTGAGCAAGAAATAGGCAAAGCAACCGCAAAATATTTCTTTTACTCTAATA
TCATGAACTTCTTCAAAACAGAAATTACACTTGCAAATGGAGAGATTCGCAAACG
CCCTCTAATCGAAACTAATGGGGAAACTGGAGAAATTGTCTGGGATAAAGGGCG
AGATTTTGCCACAGTGCGCAAAGTATTGTCCATGCCCCAAGTCAATATTGTCAAG
AAAACAGAAGTACAGACAGGCGGATTCTCCAAGGAGTCAATTTTACCAAAAAGA
AATTCGGACAAGCTTATTGCTCGTAAAAAAGACTGGGATCCAAAAAAATATGGTG
GTTTTGATAGTCCAACGGTAGCTTATTCAGTCCTAGTGGTTGCTAAGGTGGAAAA
AGGGAAATCGAAGAAGTTAAAATCCGTTAAAGAGTTACTAGGGATCACAATTATG
GAAAGAAGTTCCTTTGAAAAAAATCCGATTGACTTTTTAGAAGCTAAAGGATATA
AGGAAGTTAAAAAAGACTTAATCATTAAACTACCTAAATATAGTCTTTTTGAGTTA
GAAAACGGTCGTAAACGGATGCTGGCTAGTGCCGGAGAATTACAAAAAGGAAAT
GAGCTGGCTCTGCCAAGCAAATATGTGAATTTTTTATATTTAGCTAGTCATTATG
AAAAGTTGAAGGGTAGTCCAGAAGATAACGAACAAAAACAATTGTTTGTGGAGC
AGCATAAGCATTATTTAGATGAGATTATTGAGCAAATCAGTGAATTTTCTAAGCG
TGTTATTTTAGCAGATGCCAATTTAGATAAAGTTCTTAGTGCATATAACAAACATA
GAGACAAACCAATACGTGAACAAGCAGAAAATATTATTCATTTATTTACGTTGAC
GAATCTTGGAGCTCCCGCTGCTTTTAAATATTTTGATACAACAATTGATCGTAAA
CGATATACGTCTACAAAAGAAGTTTTAGATGCCACTCTTATCCATCAATCCATCA
CTGGTCTTTATGAAACACGCATTGATTTGAGTCAGCTAGGAGGTCCTAGGGGAG
GTGGCTCAGAAGGTGGCGGATCTGAAGGTGGCTCTGGAactagtATGAGCGATAA
AATTATTCACCTGACTGACGACAGTTTTGACACGGATGTACTCAAAGCGGACGG
GGCGATCCTCGTCGATTTCTGGGCAGAGTGGTGCGGTCCGTGCAAAATGATCG
CCCCGATTCTGGATGAAATCGCTGACGAATATCAGGGCAAACTGACCGTTGCAA
AACTGAACATCGATCAAAACCCTGGCACTGCGCCGAAATATGGCATCCGTGGTA
TCCCGACTCTGCTGCTGTTCAAAAACGGTGAAGTGGCGGCAACCAAAGTGGGT
GCACTGTCTAAAGGTCAGTTGAAAGAGTTCCTCGACGCTAACCTGGCCGGTTCT
GGTTCTGGCCATATGCACCATCATCATCATCATTCTTCTGGTCTGGTGCCACGC
GGTTCTGGTATGAAAGAAACCGCTGCTGCTAAATTCGAACGCCAGCACATGGAC
AGCCCAGATCTGGGTACCGACGACGACGACAAGGCCATGGCTGATATCggatccC
ATATGGAAATGATGCTCGATAAGAAACAGATTCGTGCGATCTTTCTCTTTGAGTT
TAAAATGGGTCGCAAAGCGGCGGAGACGACGCGTAATATTAACAACGCGTTCG
GTCCTGGCACCGCGAACGAGCGTACCGTGCAATGGTGGTTCAAAAAGTTTCGC
AAAGGCGACGAATCTCTGGAGGACGAAGAGCGTTCTGGCCGCCCGTCCGAGGT
TGACAACGACCAGCTGCGTGCAATCATCGAAGCTGATCCGCTGACTACCACCC
GCGAAGTTGCTGAAGAACTGAATGTGGATCACTCTACTGTGGTTCGCCACCTGA
AACAGATCGGTAAAGTAAAAAAACTGGACAAATGGGTTCCTCATGAACTGTCTG
AAAACCAGAAAAACCGTCGTTTCGAAGTTAGCTCCTCTCTGATTCTGCGTAACAA

CAACGAACCGTTCCTGGATCGTATCGTAACCTGTGATGAGAAATGGATTCTGTA
TGATAACCGTCGCCGCTCTGCTCAGTGGCTGGATCGCGAAGAAGCTCCAAAAC
ACTTCCCGAAACCGAATCTGCACCAGAAGAAAGTCATGGTAACCGTATGGTGGT
CTGCCGCAGGTGTTATCCACTATTCCTTCCTGAACCCGGGCGAAACTATCACCA
GCGAAAAATACTGCCAGCAGATTGACGAAATGCACCGTAAACTGCAGCGTCTGC
AGCCAGCACTGGTGAATCGTAAAGGTCCGATCCTGCTGCATGATAACGCCCGTC
CGCACGTTGCCCAACCGACCCTGCAGAAACTGAACGAACTGGGCTATGAAGTT
CTGCCACACCCGCCGTACTCCCCGGATCTGTCCCCGACTGACTACCATTTCTTC
AAGCATCTGGACAACTTCCTGCAGGGTAAACGTTTTCACAACCAACAGGACGCA
GAAAACGCTTTCCAGGAGTTCGTCGAAAGCCGTTCCACTGACTTCTACGCGACC
GGTATCAACAAGCTGATCAGCCGTTGGCAGAAATGCGTGGACTGTAACGGCAG
CTACTTCGATTAAGACGTCTTAATAACTAAAAATATGGTATAATACTCTTAATAAA
TGCAGTAATACAGGGGCTTTTCAAGACTGAAGTCTAGCTGAGACAAATAGTGCG
ATTACGAAATTTTTTAGACAAAAATAGTCTACGAGGTTTTAGAGCTATGCTGTTTT
GAATGGTCCCAAAACGGTTTTCCCAGTCACGACGTTGTAAAACGAGTTTTAGAG
CTATGCTGTTTTGAATGGTCCCAAAACTTCAGCACACTGAGACTTGTTGAGTTCC
ATGTTTTAGAGCTATGCTGTTTTGAATGGACTCCATTCAACATTGCCGATGATAA
CTTGAGAAAGAGGGTTAATACCAGCAGTCGGATACCTTCCTATTCTTTCTGTTAA
AGCGTTTTCATGTTATAATAGGCAAAAGAAGAGTAGTGTGATCGTCCATTCCGAC
AGCATCGCCAGTCACTATGGCGTGCTGCTAGCGCTATATGCGTTGATGCAATTT
CTATGCGCACCCGTTCTCGGAGCACTGTCCGACCGCTTTGGCCGCCGCCCAGT
CCTGCTCGCTTCGCTACTTGGAGCCACTATCGACTACGCGATCATGGCGACCAC
ACCCGTCCTGTGGATCCTCTACGCCGGACGCATCGTGGCCGGCATCACCGGCG
CCACAGGTGCGGTTGCTGGCGCCTATATCGCCGACATCACCGATGGGGAAGAT
CGGGCTCGCCACTTCGGGCTCATGAGCGCTTGTTTCGGCGTGGGTATGGTGGC
AGGCCCCGTGGCCGGGGGACTGTTGGGCGCCATCTCCTTGCATGCACCATTCC
TTGCGGCGGCGGTGCTCAACGGCCTCAACCTACTACTGGGCTGCTTCCTAATG
CAGGAGTCGCATAAGGGAGAGCGTCGACCGATGCCCTTGAGAGCCTTCAACCC
AGTCAGCTCCTTCCGGTGGGCGCGGGGCATGACTATCGTCGCCGCACTTATGA
CTGTCTTCTTTATCATGCAACTCGTAGGACAGGTGCCGGCAGCGCTCTGGGTCA
TTTTCGGCGAGGACCGCTTTCGCTGGAGCGCGACGATGATCGGCCTGTCGCTT
GCGGTATTCGGAATCTTGCACGCCCTCGCTCAAGCCTTCGTCACTGGTCCCGC
CACCAAACGTTTCGGCGAGAAGCAGGCCATTATCGCCGGCATGGCGGCCGACG
CGCTGGGCTACGTCTTGCTGGCGTTCGCGACGCGAGGCTGGATGGCCTTCCCC
ATTATGATTCTTCTCGCTTCCGGCGGCATCGGGATGCCCGCGTTGCAGGCCATG
CTGTCCAGGCAGGTAGATGACGACCATCAGGGACAGCTTCAAGGATCGCTCGC
GGCTCTTACCAGCCTAACTTCGATCATTGGACCGCTGATCGTCACGGCGATTTA
TGCCGCCTCGGCGAGCACATGGAACGGGTTGGCATGGATTGTAGGCGCCGCC
CTATACCTTGTCTGCCTCCCCGCGTTGCGTCGCGGTGCATGGAGCCGGGCCAC
CTCGACCTGAATGGAAGCCGGCGGCACCTCGCTAACGGATTCACCACTCCAAG
AATTGGAGCCAATCAATTCTTGCGGAGAACTGTGAATGCGCAAACCAACCCTTG
GCAGAACATATCCATCGCGTCCGCCATCTCCAGCAGCCGCACGCGGCGCATCT
CGGGCAGCGTTGGGTCCTGGCCACGGGTGCGCATGATCGTGCTCCTGTCGTTG
AGGACCCGGCTAGGCTGGCGGGGTTGCCTTACTGGTTAGCAGAATGAATCACC

GATACGCGAGCGAACGTGAAGCGACTGCTGCTGCAAAACGTCTGCGACCTGAG
CAACAACATGAATGGTCTTCGGTTTCCGTGTTTCGTAAAGTCTGGAAACGCGGA
AGTCCCCTACGTGCTGCTGAAGTTGCCCGCAACAGAGAGTGGAACCAACCGGT
GATACCACGATACTATGACTGAGAGTCAACGCCATGAGCGGCCTCATTTCTTAT
TCTGAGTTACAACAGTCCGCACCGCTGTCCGGTAGCTCCTTCCGGTGGGCGCG
GGGCATGACTATCGTCGCCGCACTTATGACTGTCTTCTTTATCATGCAACTCGTA
GGACAGGTGCCGGCAGCGCCCAACAGTCCCCCGGCCACGGGGCCTGCCACCA
TACCCACGCCGAAACAAGCGCCCTGCACCATTATGTTCCGGATCTGCATCGCAG
GATGCTGCTGGCTACCCTGTGGAACACCTACATCTGTATTAACGAAGCGCTAAC
CGTTTTTATCAGGCTCTGGGAGGCAGAATAAATGATCATATCGTCAATTATTACC
TCCACGGGGAGAGCCTGAGCAAACTGGCCTCAGGCATTTGAGAAGCACACGGT
CACACTGCTTCCGGTAGTCAATAAACCGGTAAACCAGCAATAGACATAAGCGGC
TATTTAACGACCCTGCCCTGAACCGACGACCGGGTCGAATTTGCTTTCGAATTT
CTGCCATTCATCCGCTTATTATCACTTATTCAGGCGTAGCACCAGGCGTTTAAGG
GCACCAATAACTGCCTTAAAAAAATTACGCCCCGCCCTGCCACTCATCGCAGTA
CTGTTGTAATTCATTAAGCATTCTGCCGACATGGAAGCCATCACAGACGGCATG
ATGAACCTGAATCGCCAGCGGCATCAGCACCTTGTCGCCTTGCGTATAATATTT
GCCCATGGTGAAAACGGGGGCGAAGAAGTTGTCCATATTGGCCACGTTTAAATC
AAAACTGGTGAAACTCACCCAGGGATTGGCTGAGACGAAAAACATATTCTCAAT
AAACCCTTTAGGGAAATAGGCCAGGTTTTCACCGTAACACGCCACATCTTGCGA
ATATATGTGTAGAAACTGCCGGAAATCGTCGTGGTATTCACTCCAGAGCGATGA
AAACGTTTCAGTTTGCTCATGGAAAACGGTGTAACAAGGGTGAACACTATCCCA
TATCACCAGCTCACCGTCTTTCATTGCCATACG

pRC2308

GAATTCCGGATGAGCATTCATCAGGCGGGCAAGAATGTGAATAAAGGCCGGAT
AAAACTTGTGCTTATTTTTCTTTACGGTCTTTAAAAAGGCCGTAATATCCAGCTGA
ACGGTCTGGTTATAGGTACATTGAGCAACTGACTGAAATGCCTCAAAATGTTCTT
TACGATGCCATTGGGATATATCAACGGTGGTATATCCAGTGATTTTTTTCTCCAT
TTTAGCTTCCTTAGCTCCTGAAAATCTCGATAACTCAAAAAATACGCCCGGTAGT
GATCTTATTTCATTATGGTGAAAGTTGGAACCTCTTACGTGCCGATCAACGTCTC
ATTTTCGCCAAAAGTTGGCCCAGGGCTTCCCGGTATCAACAGGGACACCAGGAT
TTATTTATTCTGCGAAGTGATCTTCCGTCACAGGTATTTATTCGGCGCAAAGTGC
GTCGGGTGATGCTGCCAACTTACTGATTTAGTGTATGATGGTGTTTTTGAGGTG
CTCCAGTGGCTTCTGTTTCTATCAGCTGTCCCTCCTGTTCAGCTACTGACGGGG
TGGTGCGTAACGGCAAAAGCACCGCCGGACATCAGCGCTAGCGGAGTGTATAC
TGGCTTACTATGTTGGCACTGATGAGGGTGTCAGTGAAGTGCTTCATGTGGCAG
GAGAAAAAAGGCTGCACCGGTGCGTCAGCAGAATATGTGATACAGGATATATTC
CGCTTCCTCGCTCACTGACTCGCTACGCTCGGTCGTTCGACTGCGGCGAGCGG
AAATGGCTTACGAACGGGGCGGAGATTTCCTGGAAGATGCCAGGAAGATACTTA
ACAGGGAAGTGAGAGGGCCGCGGCAAAGCCGTTTTTCCATAGGCTCCGCCCCC
CTGACAAGCATCACGAAATCTGACGCTCAAATCAGTGGTGGCGAAACCCGACA
GGACTATAAAGATACCAGGCGTTTCCCCCTGGCGGCTCCCTCGTGCGCTCTCCT

GTTCCTGCCTTTCGGTTTACCGGTGTCATTCCGCTGTTATGGCCGCGTTTGTCT
CATTCCACGCCTGACACTCAGTTCCGGGTAGGCAGTTCGCTCCAAGCTGGACT
GTATGCACGAACCCCCCGTTCAGTCCGACCGCTGCGCCTTATCCGGTAACTATC
GTCTTGAGTCCAACCCGGAAAGACATGCAAAAGCACCACTGGCAGCAGCCACT
GGTAATTGATTTAGAGGAGTTAGTCTTGAAGTCATGCGCCGGTTAAGGCTAAAC
TGAAAGGACAAGTTTTGGTGACTGCGCTCCTCCAAGCCAGTTACCTCGGTTCAA
AGAGTTGGTAGCTCAGAGAACCTTCGAAAAACCGCCCTGCAAGGCGGTTTTTTC
GTTTTCAGAGCAAGAGATTACGCGCAGACCAAAACGATCTCAAGAAGATCATCT
TATTAATCAGATAAAATATTTCTAGATTTCAGTGCAATTTATCTCTTCAAATGTAG
CACCTGAAGTCAGCCCCATACGATATAAGTTGTAATTCTCATGTTTGACAGCTTA
TCATCGATAAGCTTTAATGCGGTAGTTTATCACAGTTAAATTGCTAACGCAGTCA
GGCACCGTGTATGAAATCTAACAATGCGCTCATCGTCATCCTCGGCACCGTCAC
CCTGGATGCTGTAGGCATAGGCTTGGTTATGCCGGTACTGCCGGGCCTCTTGC
GGGATTACGAAATCATCCTGTGGAGCTTAGTAGGTTTAGCAAGATGGCAGCGCC
TAAATGTAGAATGATAAAAGGATTAAGAGATTAATTTCCCTAAAAATGATAAAACA
AGCGTTTTGAAAGCGCTTGTTTTTTTGGTTTGCAGTCAGAGTAGAATAGAAGTAT
CAAAAAAAGCACCGACTCGGTGCCACTTTTTCAAGTTGATAACGGACTAGCCTT
ATTTTAACTTGCTATGCTGTTTTGAATGGTTCCAACAAGATTATTTTATAACTTTTA
TAACAAATAATCAAGGAGAAATTCAAAGAAATTTATCAGCCATAAAACAATACTTA
ATACTATAGAATGATAACAAAATAAACTACTTTTTAAAAGAATTTTGTGTTATAATC
TATTTATTATTAAGTATTGGGTAATATTTTTTGAAGAGCGGCCGCGTTAATAACAG
GGGACGTGGTAATCCGTCCCCTTTTTATTTCTGACTGAGTTAATAACAGGCCTG
CTTCGGCAGGCCTTTTTATTTCTGACTGAGTTCTTCTCAGGCCTGCTGGTAATCG
CAGGCCTTTTTATTTTCTAGTCTGACTGACTGACTGACTGACTGACTGACTGACT
GACTGACTGACTGACTGACTGACTGACTGACTGACTGACTGACTGACTGACTGA
CTGACTGACTGACTGACTGACTGACTGACTGACTGACTGACTGACTGACTGACT
GACTGACTGACTGACTGACTGACTgactgaCTGACCTCGAGATGGATAAGAA
ATACTCAATAGGCTTAGCTATCGGCACAAATAGCGTCGGATGGGCGGTGATCAC
TGATGAATATAAGGTTCCGTCTAAAAAGTTCAAGGTTCTGGGAAATACAGACCG
CCACAGTATCAAAAAAAATCTTATAGGGGCTCTTTTATTTGACAGTGGAGAGACA
GCGGAAGCGACTCGTCTCAAACGGACAGCTCGTAGAAGGTATACACGTCGGAA
GAATCGTATTTGTTATCTACAGGAGATTTTTTCAAATGAGATGGCGAAAGTAGAT
GATAGTTTCTTTCATCGACTTGAAGAGTCTTTTTTGGTGGAAGAAGACAAGAAGC
ATGAACGTCATCCTATTTTTGGAAATATAGTAGATGAAGTTGCTTATCATGAGAA
ATATCCAACTATCTATCATCTGCGAAAAAAATTGGTAGATTCTACTGATAAAGCG
GATTTGCGCTTAATCTATTTGGCCTTAGCGCATATGATTAAGTTTCGTGGTCATT
TTTTGATTGAGGGAGATTTAAATCCTGATAATAGTGATGTGGACAAACTATTTAT
CCAGTTGGTACAAACCTACAATCAATTATTTGAAGAAAACCCTATTAACGCAAGT
GGAGTAGATGCTAAAGCGATTCTTTCTGCACGATTGAGTAAATCAAGACGATTA
GAAAATCTCATTGCTCAGCTCCCCGGTGAGAAGAAAAATGGCTTATTTGGGAAT
CTCATTGCTTTGTCATTGGGTTTGACCCCTAATTTTAAATCAAATTTTGATTTGGC
AGAAGATGCTAAATTACAGCTTTCAAAAGATACTTACGATGATGATTTAGATAATT
TATTGGCGCAAATTGGAGATCAATATGCTGATTTGTTTTTGGCAGCTAAGAATTT
ATCAGATGCTATTTTACTTTCAGATATCCTAAGAGTAAATACTGAAATAACTAAGG

CTCCCCTATCAGCTTCAATGATTAAACGCTACGATGAACATCATCAAGACTTGAC
TCTTTTAAAAGCTTTAGTTCGACAACAACTTCCAGAAAAGTATAAAGAAATCTTTT
TTGATCAATCAAAAAACGGATATGCAGGTTATATTGATGGGGGAGCTAGCCAAG
AAGAATTTTATAAATTTATCAAACCAATTTTAGAAAAAATGGATGGTACTGAGGAA
TTATTGGTGAAACTAAATCGTGAAGATTTGCTGCGCAAGCAACGGACCTTTGAC
AACGGCTCTATTCCCCATCAAATTCACTTGGGTGAGCTGCATGCTATTTTGAGAA
GACAAGAAGACTTTTATCCATTTTTAAAAGACAATCGTGAGAAGATTGAAAAAAT
CTTGACTTTTCGAATTCCTTATTATGTTGGTCCATTGGCGCGTGGCAATAGTCGT
TTTGCATGGATGACTCGGAAGTCTGAAGAAACAATTACCCCATGGAATTTTGAAG
AAGTTGTCGATAAAGGTGCTTCAGCTCAATCATTTATTGAACGCATGACAAACTT
TGATAAAAATCTTCCAAATGAAAAAGTACTACCAAAACATAGTTTGCTTTATGAGT
ATTTTACGGTTTATAACGAATTGACAAAGGTCAAATATGTTACTGAAGGAATGCG
AAAACCAGCATTTCTTTCAGGTGAACAGAAGAAAGCCATTGTTGATTTACTCTTC
AAAACAAATCGAAAAGTAACCGTTAAGCAATTAAAAGAAGATTATTTCAAAAAAAT
AGAATGTTTTGATAGTGTTGAAATTTCAGGAGTTGAAGATAGATTTAATGCTTCAT
TAGGTACCTACCATGATTTGCTAAAAATTATTAAAGATAAAGATTTTTTGGATAAT
GAAGAAAATGAAGATATCTTAGAGGATATTGTTTTAACATTGACCTTATTTGAAGA
TAGGGAGATGATTGAGGAAAGACTTAAAACATATGCTCACCTCTTTGATGATAAG
GTGATGAAACAGCTTAAACGTCGCCGTTATACTGGTTGGGGACGTTTGTCTCGA
AAATTGATTAATGGTATTAGGGATAAGCAATCTGGCAAAACAATATTAGATTTTTT
GAAATCAGATGGTTTTGCCAATCGCAATTTTATGCAGCTGATCCATGATGATAGT
TTGACATTTAAAGAAGACATTCAAAAAGCACAAGTGTCTGGACAAGGCGATAGTT
TACATGAACATATTGCAAATTTAGCTGGTAGCCCTGCTATTAAAAAAGGTATTTTA
CAGACTGTAAAAGTTGTTGATGAATTGGTCAAAGTAATGGGGCGGCATAAGCCA
GAAAATATCGTTATTGAAATGGCACGTGAAAATCAGACAACTCAAAAGGGCCAG
AAAAATTCGCGAGAGCGTATGAAACGAATCGAAGAAGGTATCAAAGAATTAGGA
AGTCAGATTCTTAAAGAGCATCCTGTTGAAAATACTCAATTGCAAAATGAAAAGC
TCTATCTCTATTATCTCCAAAATGGAAGAGACATGTATGTGGACCAAGAATTAGA
TATTAATCGTTTAAGTGATTATGATGTCGATGCCATTGTTCCACAAAGTTTCCTTA
AAGACGATTCAATAGACAATAAGGTCTTAACGCGTTCTGATAAAAATCGTGGTAA
ATCGGATAACGTTCCAAGTGAAGAAGTAGTCAAAAAGATGAAAAACTATTGGAG
ACAACTTCTAAACGCCAAGTTAATCACTCAACGTAAGTTTGATAATTTAACGAAA
GCTGAACGTGGAGGTTTGAGTGAACTTGATAAAGCTGGTTTTATCAAACGCCAA
TTGGTTGAAACTCGCCAAATCACTAAGCATGTGGCACAAATTTTGGATAGTCGCA
TGAATACTAAATACGATGAAAATGATAAACTTATTCGAGAGGTTAAAGTGATTAC
CTTAAAATCTAAATTAGTTTCTGACTTCCGAAAAGATTTCCAATTCTATAAAGTAC
GTGAGATTAACAATTACCATCATGCCCATGATGCGTATCTAAATGCCGTCGTTGG
AACTGCTTTGATTAAGAAATATCCAAAACTTGAATCGGAGTTTGTCTATGGTGAT
TATAAAGTTTATGATGTTCGTAAAATGATTGCTAAGTCTGAGCAAGAAATAGGCA
AAGCAACCGCAAAATATTTCTTTTACTCTAATATCATGAACTTCTTCAAAACAGAA
ATTACACTTGCAAATGGAGAGATTCGCAAACGCCCTCTAATCGAAACTAATGGG
GAAACTGGAGAAATTGTCTGGGATAAAGGGCGAGATTTTGCCACAGTGCGCAAA
GTATTGTCCATGCCCCAAGTCAATATTGTCAAGAAAACAGAAGTACAGACAGGC
GGATTCTCCAAGGAGTCAATTTTACCAAAAAGAAATTCGGACAAGCTTATTGCTC

GTAAAAAAGACTGGGATCCAAAAAAATATGGTGGTTTTGATAGTCCAACGGTAG
CTTATTCAGTCCTAGTGGTTGCTAAGGTGGAAAAAGGGAAATCGAAGAAGTTAA
AATCCGTTAAAGAGTTACTAGGGATCACAATTATGGAAAGAAGTTCCTTTGAAAA
AAATCCGATTGACTTTTTAGAAGCTAAAGGATATAAGGAAGTTAAAAAAGACTTA
ATCATTAAACTACCTAAATATAGTCTTTTTGAGTTAGAAAACGGTCGTAAACGGA
TGCTGGCTAGTGCCGGAGAATTACAAAAAGGAAATGAGCTGGCTCTGCCAAGC
AAATATGTGAATTTTTTATATTTAGCTAGTCATTATGAAAAGTTGAAGGGTAGTCC
AGAAGATAACGAACAAAAACAATTGTTTGTGGAGCAGCATAAGCATTATTTAGAT
GAGATTATTGAGCAAATCAGTGAATTTTCTAAGCGTGTTATTTTAGCAGATGCCA
ATTTAGATAAAGTTCTTAGTGCATATAACAAACATAGAGACAAACCAATACGTGA
ACAAGCAGAAAATATTATTCATTTATTTACGTTGACGAATCTTGGAGCTCCCGCT
GCTTTTAAATATTTTGATACAACAATTGATCGTAAACGATATACGTCTACAAAAGA
AGTTTTAGATGCCACTCTTATCCATCAATCCATCACTGGTCTTTATGAAACACGC
ATTGATTTGAGTCAGCTAGGAGGTCCTAGGGGAGGTGGCTCAGAAGGTGGCGG
ATCTGAAGGTGGCTCTGGAactagtATGAGCGATAAAATTATTCACCTGACTGACG
ACAGTTTTGACACGGATGTACTCAAAGCGGACGGGGCGATCCTCGTCGATTTCT
GGGCAGAGTGGTGCGGTCCGTGCAAAATGATCGCCCCGATTCTGGATGAAATC
GCTGACGAATATCAGGGCAAACTGACCGTTGCAAAACTGAACATCGATCAAAAC
CCTGGCACTGCGCCGAAATATGGCATCCGTGGTATCCCGACTCTGCTGCTGTTC
AAAAACGGTGAAGTGGCGGCAACCAAAGTGGGTGCACTGTCTAAAGGTCAGTT
GAAAGAGTTCCTCGACGCTAACCTGGCCGGTTCTGGTTCTGGCCATATGCACCA
TCATCATCATCATTCTTCTGGTCTGGTGCCACGCGGTTCTGGTATGAAAGAAAC
CGCTGCTGCTAAATTCGAACGCCAGCACATGGACAGCCCAGATCTGGGTACCG
ACGACGACGACAAGGCCATGGCTGATATCggatccCATATGGAAATGATGCTCGAT
AAGAAACAGATTCGTGCGATCTTTCTCTTTGAGTTTAAAATGGGTCGCAAAGCG
GCGGAGACGACGCGTAATATTAACAACGCGTTCGGTCCTGGCACCGCGAACGA
GCGTACCGTGCAATGGTGGTTCAAAAAGTTTCGCAAAGGCGACGAATCTCTGGA
GGACGAAGAGCGTTCTGGCCGCCCGTCCGAGGTTGACAACGACCAGCTGCGTG
CAATCATCGAAGCTGATCCGCTGACTACCACCCGCGAAGTTGCTGAAGAACTGA
ATGTGGATCACTCTACTGTGGTTCGCCACCTGAAACAGATCGGTAAAGTAAAAA
AACTGGACAAATGGGTTCCTCATGAACTGTCTGAAAACCAGAAAAACCGTCGTT
TCGAAGTTAGCTCCTCTCTGATTCTGCGTAACAACAACGAACCGTTCCTGGATC
GTATCGTAACCTGTGATGAGAAATGGATTCTGTATGATAACCGTCGCCGCTCTG
CTCAGTGGCTGGATCGCGAAGAAGCTCCAAAACACTTCCCGAAACCGAATCTGC
ACCAGAAGAAAGTCATGGTAACCGTATGGTGGTCTGCCGCAGGTGTTATCCACT
ATTCCTTCCTGAACCCGGGCGAAACTATCACCAGCGAAAAATACTGCCAGCAGA
TTGACGAAATGCACCGTAAACTGCAGCGTCTGCAGCCAGCACTGGTGAATCGTA
AAGGTCCGATCCTGCTGCATGATAACGCCCGTCCGCACGTTGCCCAACCGACC
CTGCAGAAACTGAACGAACTGGGCTATGAAGTTCTGCCACACCCGCCGTACTCC
CCGGATCTGTCCCCGACTGACTACCATTTCTTCAAGCATCTGGACAACTTCCTG
CAGGGTAAACGTTTTCACAACCAACAGGACGCAGAAAACGCTTTCCAGGAGTTC
GTCGAAAGCCGTTCCACTGACTTCTACGCGACCGGTATCAACAAGCTGATCAGC
CGTTGGCAGAAATGCGTGGACTGTAACGGCAGCTACTTCGATTAAGACGTCTTA
ATAACTAAAAATATGGTATAATACTCTTAATAAATGCAGTAATACAGGGGCTTTTC

AAGACTGAAGTCTAGCTGAGACAAATAGTGCGATTACGAAATTTTTTAGACAAAA
ATAGTCTACGAGGTTTTAGAGCTATGCTGTTTTGAATGGTCCCAAAACGGTTTTC
CCAGTCACGACGTTGTAAAACGAGTTTTAGAGCTATGCTGTTTTGAATGGTCCCA
AAACTTCAGCACACTGAGACTTGTTGAGTTCCATGTTTTAGAGCTATGCTGTTTT
GAATGGACTCCATTCAACATTGCCGATGATAACTTGAGAAAGAGGGTTAATACC
AGCAGTCGGATACCTTCCTATTCTTTCTGTTAAAGCGTTTTCATGTTATAATAGG
CAAAAGAAGAGTAGTGTGATCGTCCATTCCGACAGCATCGCCAGTCACTATGGC
GTGCTGCTAGCGCTATATGCGTTGATGCAATTTCTATGCGCACCCGTTCTCGGA
GCACTGTCCGACCGCTTTGGCCGCCGCCCAGTCCTGCTCGCTTCGCTACTTGG
AGCCACTATCGACTACGCGATCATGGCGACCACACCCGTCCTGTGGATCCTCTA
CGCCGGACGCATCGTGGCCGGCATCACCGGCGCCACAGGTGCGGTTGCTGGC
GCCTATATCGCCGACATCACCGATGGGGAAGATCGGGCTCGCCACTTCGGGCT
CATGAGCGCTTGTTTCGGCGTGGGTATGGTGGCAGGCCCCGTGGCCGGGGGA
CTGTTGGGCGCCATCTCCTTGCATGCACCATTCCTTGCGGCGGCGGTGCTCAA
CGGCCTCAACCTACTACTGGGCTGCTTCCTAATGCAGGAGTCGCATAAGGGAG
AGCGTCGACCGATGCCCTTGAGAGCCTTCAACCCAGTCAGCTCCTTCCGGTGG
GCGCGGGGCATGACTATCGTCGCCGCACTTATGACTGTCTTCTTTATCATGCAA
CTCGTAGGACAGGTGCCGGCAGCGCTCTGGGTCATTTTCGGCGAGGACCGCTT
TCGCTGGAGCGCGACGATGATCGGCCTGTCGCTTGCGGTATTCGGAATCTTGC
ACGCCCTCGCTCAAGCCTTCGTCACTGGTCCCGCCACCAAACGTTTCGGCGAG
AAGCAGGCCATTATCGCCGGCATGGCGGCCGACGCGCTGGGCTACGTCTTGCT
GGCGTTCGCGACGCGAGGCTGGATGGCCTTCCCCATTATGATTCTTCTCGCTTC
CGGCGGCATCGGGATGCCCGCGTTGCAGGCCATGCTGTCCAGGCAGGTAGAT
GACGACCATCAGGGACAGCTTCAAGGATCGCTCGCGGCTCTTACCAGCCTAAC
TTCGATCATTGGACCGCTGATCGTCACGGCGATTTATGCCGCCTCGGCGAGCA
CATGGAACGGGTTGGCATGGATTGTAGGCGCCGCCCTATACCTTGTCTGCCTC
CCCGCGTTGCGTCGCGGTGCATGGAGCCGGGCCACCTCGACCTGAATGGAAG
CCGGCGGCACCTCGCTAACGGATTCACCACTCCAAGAATTGGAGCCAATCAATT
CTTGCGGAGAACTGTGAATGCGCAAACCAACCCTTGGCAGAACATATCCATCGC
GTCCGCCATCTCCAGCAGCCGCACGCGGCGCATCTCGGGCAGCGTTGGGTCCT
GGCCACGGGTGCGCATGATCGTGCTCCTGTCGTTGAGGACCCGGCTAGGCTGG
CGGGGTTGCCTTACTGGTTAGCAGAATGAATCACCGATACGCGAGCGAACGTG
AAGCGACTGCTGCTGCAAAACGTCTGCGACCTGAGCAACAACATGAATGGTCTT
CGGTTTCCGTGTTTCGTAAAGTCTGGAAACGCGGAAGTCCCCTACGTGCTGCTG
AAGTTGCCCGCAACAGAGAGTGGAACCAACCGGTGATACCACGATACTATGACT
GAGAGTCAACGCCATGAGCGGCCTCATTTCTTATTCTGAGTTACAACAGTCCGC
ACCGCTGTCCGGTAGCTCCTTCCGGTGGGCGCGGGGCATGACTATCGTCGCCG
CACTTATGACTGTCTTCTTTATCATGCAACTCGTAGGACAGGTGCCGGCAGCGC
CCAACAGTCCCCCGGCCACGGGGCCTGCCACCATACCCACGCCGAAACAAGC
GCCCTGCACCATTATGTTCCGGATCTGCATCGCAGGATGCTGCTGGCTACCCTG
TGGAACACCTACATCTGTATTAACGAAGCGCTAACCGTTTTTATCAGGCTCTGG
GAGGCAGAATAAATGATCATATCGTCAATTATTACCTCCACGGGGAGAGCCTGA
GCAAACTGGCCTCAGGCATTTGAGAAGCACACGGTCACACTGCTTCCGGTAGTC
AATAAACCGGTAAACCAGCAATAGACATAAGCGGCTATTTAACGACCCTGCCCT

GAACCGACGACCGGGTCGAATTTGCTTTCGAATTTCTGCCATTCATCCGCTTATT
ATCACTTATTCAGGCGTAGCACCAGGCGTTTAAGGGCACCAATAACTGCCTTAA
AAAAATTACGCCCCGCCCTGCCACTCATCGCAGTACTGTTGTAATTCATTAAGCA
TTCTGCCGACATGGAAGCCATCACAGACGGCATGATGAACCTGAATCGCCAGC
GGCATCAGCACCTTGTCGCCTTGCGTATAATATTTGCCCATGGTGAAAACGGGG
GCGAAGAAGTTGTCCATATTGGCCACGTTTAAATCAAAACTGGTGAAACTCACC
CAGGGATTGGCTGAGACGAAAAACATATTCTCAATAAACCCTTTAGGGAAATAG
GCCAGGTTTTCACCGTAACACGCCACATCTTGCGAATATATGTGTAGAAACTGC
CGGAAATCGTCGTGGTATTCACTCCAGAGCGATGAAAACGTTTCAGTTTGCTCA
TGGAAAACGGTGTAACAAGGGTGAACACTATCCCATATCACCAGCTCACCGTCT
TTCATTGCCATACG

pRC2309

GAATTCCGGATGAGCATTCATCAGGCGGGCAAGAATGTGAATAAAGGCCGGAT
AAAACTTGTGCTTATTTTTCTTTACGGTCTTTAAAAAGGCCGTAATATCCAGCTGA
ACGGTCTGGTTATAGGTACATTGAGCAACTGACTGAAATGCCTCAAAATGTTCTT
TACGATGCCATTGGGATATATCAACGGTGGTATATCCAGTGATTTTTTTCTCCAT
TTTAGCTTCCTTAGCTCCTGAAAATCTCGATAACTCAAAAAATACGCCCGGTAGT
GATCTTATTTCATTATGGTGAAAGTTGGAACCTCTTACGTGCCGATCAACGTCTC
ATTTTCGCCAAAAGTTGGCCCAGGGCTTCCCGGTATCAACAGGGACACCAGGAT
TTATTTATTCTGCGAAGTGATCTTCCGTCACAGGTATTTATTCGGCGCAAAGTGC
GTCGGGTGATGCTGCCAACTTACTGATTTAGTGTATGATGGTGTTTTTGAGGTG
CTCCAGTGGCTTCTGTTTCTATCAGCTGTCCCTCCTGTTCAGCTACTGACGGGG
TGGTGCGTAACGGCAAAAGCACCGCCGGACATCAGCGCTAGCGGAGTGTATAC
TGGCTTACTATGTTGGCACTGATGAGGGTGTCAGTGAAGTGCTTCATGTGGCAG
GAGAAAAAAGGCTGCACCGGTGCGTCAGCAGAATATGTGATACAGGATATATTC
CGCTTCCTCGCTCACTGACTCGCTACGCTCGGTCGTTCGACTGCGGCGAGCGG
AAATGGCTTACGAACGGGGCGGAGATTTCCTGGAAGATGCCAGGAAGATACTTA
ACAGGGAAGTGAGAGGGCCGCGGCAAAGCCGTTTTTCCATAGGCTCCGCCCCC
CTGACAAGCATCACGAAATCTGACGCTCAAATCAGTGGTGGCGAAACCCGACA
GGACTATAAAGATACCAGGCGTTTCCCCCTGGCGGCTCCCTCGTGCGCTCTCCT
GTTCCTGCCTTTCGGTTTACCGGTGTCATTCCGCTGTTATGGCCGCGTTTGTCT
CATTCCACGCCTGACACTCAGTTCCGGGTAGGCAGTTCGCTCCAAGCTGGACT
GTATGCACGAACCCCCCGTTCAGTCCGACCGCTGCGCCTTATCCGGTAACTATC
GTCTTGAGTCCAACCCGGAAAGACATGCAAAAGCACCACTGGCAGCAGCCACT
GGTAATTGATTTAGAGGAGTTAGTCTTGAAGTCATGCGCCGGTTAAGGCTAAAC
TGAAAGGACAAGTTTTGGTGACTGCGCTCCTCCAAGCCAGTTACCTCGGTTCAA
AGAGTTGGTAGCTCAGAGAACCTTCGAAAAACCGCCCTGCAAGGCGGTTTTTTC
GTTTTCAGAGCAAGAGATTACGCGCAGACCAAAACGATCTCAAGAAGATCATCT
TATTAATCAGATAAAATATTTCTAGATTTCAGTGCAATTTATCTCTTCAAATGTAG
CACCTGAAGTCAGCCCCATACGATATAAGTTGTAATTCTCATGTTTGACAGCTTA
TCATCGATAAGCTTTAATGCGGTAGTTTATCACAGTTAAATTGCTAACGCAGTCA
GGCACCGTGTATGAAATCTAACAATGCGCTCATCGTCATCCTCGGCACCGTCAC

CCTGGATGCTGTAGGCATAGGCTTGGTTATGCCGGTACTGCCGGGCCTCTTGC
GGGATTACGAAATCATCCTGTGGAGCTTAGTAGGTTTAGCAAGATGGCAGCGCC
TAAATGTAGAATGATAAAAGGATTAAGAGATTAATTTCCCTAAAAATGATAAAACA
AGCGTTTTGAAAGCGCTTGTTTTTTTGGTTTGCAGTCAGAGTAGAATAGAAGTAT
CAAAAAAAGCACCGACTCGGTGCCACTTTTTCAAGTTGATAACGGACTAGCCTT
ATTTTAACTTGCTATGCTGTTTTGAATGGTTCCAACAAGATTATTTTATAACTTTTA
TAACAAATAATCAAGGAGAAATTCAAAGAAATTTATCAGCCATAAAACAATACTTA
ATACTATAGAATGATAACAAAATAAACTACTTTTTAAAAGAATTTTGTGTTATAATC
TATTTATTATTAAGTATTGGGTAATATTTTTTGAAGAGCggccgctaatacgactcactatag
ggagaggatccgcggaattgCAGCTGGTTAATAACAGGGGACGTGGTAATCCGTCCCCT
TTTTATTTCTGACTGAGTTAATAACAGGCCTGCTTCGGCAGGCCTTTTTATTTCT
GACTGAGTTCTTCTCAGGCCTGCTGGTAATCGCAGGCCTTTTTATTTTCTAGACA
ATTCCGACGTCTAAGGAAACCATTATCATGACATCAACCTATAAAAATAGGCGTA
TCACGAGGCCCTCTCGTCTCCACCTCAAGCTCCCTATCTAGTGATAGCGATTGA
CATCCCTATCAGTGACGGAGATATTGAGCACATCAGCAGGACGCACTGACCACT
TTAAGaggaggCTCGAGATGGATAAGAAATACTCAATAGGCTTAGCTATCGGCACA
AATAGCGTCGGATGGGCGGTGATCACTGATGAATATAAGGTTCCGTCTAAAAAG
TTCAAGGTTCTGGGAAATACAGACCGCCACAGTATCAAAAAAAATCTTATAGGG
GCTCTTTTATTTGACAGTGGAGAGACAGCGGAAGCGACTCGTCTCAAACGGACA
GCTCGTAGAAGGTATACACGTCGGAAGAATCGTATTTGTTATCTACAGGAGATTT
TTTCAAATGAGATGGCGAAAGTAGATGATAGTTTCTTTCATCGACTTGAAGAGTC
TTTTTTGGTGGAAGAAGACAAGAAGCATGAACGTCATCCTATTTTTGGAAATATA
GTAGATGAAGTTGCTTATCATGAGAAATATCCAACTATCTATCATCTGCGAAAAA
AATTGGTAGATTCTACTGATAAAGCGGATTTGCGCTTAATCTATTTGGCCTTAGC
GCATATGATTAAGTTTCGTGGTCATTTTTTGATTGAGGGAGATTTAAATCCTGAT
AATAGTGATGTGGACAAACTATTTATCCAGTTGGTACAAACCTACAATCAATTATT
TGAAGAAAACCCTATTAACGCAAGTGGAGTAGATGCTAAAGCGATTCTTTCTGCA
CGATTGAGTAAATCAAGACGATTAGAAAATCTCATTGCTCAGCTCCCCGGTGAG
AAGAAAAATGGCTTATTTGGGAATCTCATTGCTTTGTCATTGGGTTTGACCCCTA
ATTTTAAATCAAATTTTGATTTGGCAGAAGATGCTAAATTACAGCTTTCAAAAGAT
ACTTACGATGATGATTTAGATAATTTATTGGCGCAAATTGGAGATCAATATGCTG
ATTTGTTTTTGGCAGCTAAGAATTTATCAGATGCTATTTTACTTTCAGATATCCTA
AGAGTAAATACTGAAATAACTAAGGCTCCCCTATCAGCTTCAATGATTAAACGCT
ACGATGAACATCATCAAGACTTGACTCTTTTAAAAGCTTTAGTTCGACAACAACT
TCCAGAAAAGTATAAAGAAATCTTTTTTGATCAATCAAAAAACGGATATGCAGGT
TATATTGATGGGGGAGCTAGCCAAGAAGAATTTTATAAATTTATCAAACCAATTTT
AGAAAAAATGGATGGTACTGAGGAATTATTGGTGAAACTAAATCGTGAAGATTTG
CTGCGCAAGCAACGGACCTTTGACAACGGCTCTATTCCCCATCAAATTCACTTG
GGTGAGCTGCATGCTATTTTGAGAAGACAAGAAGACTTTTATCCATTTTTAAAAG
ACAATCGTGAGAAGATTGAAAAAATCTTGACTTTTCGAATTCCTTATTATGTTGGT
CCATTGGCGCGTGGCAATAGTCGTTTTGCATGGATGACTCGGAAGTCTGAAGAA
ACAATTACCCCATGGAATTTTGAAGAAGTTGTCGATAAAGGTGCTTCAGCTCAAT
CATTTATTGAACGCATGACAAACTTTGATAAAAATCTTCCAAATGAAAAAGTACTA
CCAAAACATAGTTTGCTTTATGAGTATTTTACGGTTTATAACGAATTGACAAAGGT

CAAATATGTTACTGAAGGAATGCGAAAACCAGCATTTCTTTCAGGTGAACAGAA
GAAAGCCATTGTTGATTTACTCTTCAAAACAAATCGAAAAGTAACCGTTAAGCAA
TTAAAAGAAGATTATTTCAAAAAAATAGAATGTTTTGATAGTGTTGAAATTTCAGG
AGTTGAAGATAGATTTAATGCTTCATTAGGTACCTACCATGATTTGCTAAAAATTA
TTAAAGATAAAGATTTTTTGGATAATGAAGAAAATGAAGATATCTTAGAGGATATT
GTTTTAACATTGACCTTATTTGAAGATAGGGAGATGATTGAGGAAAGACTTAAAA
CATATGCTCACCTCTTTGATGATAAGGTGATGAAACAGCTTAAACGTCGCCGTTA
TACTGGTTGGGGACGTTTGTCTCGAAAATTGATTAATGGTATTAGGGATAAGCAA
TCTGGCAAAACAATATTAGATTTTTTGAAATCAGATGGTTTTGCCAATCGCAATTT
TATGCAGCTGATCCATGATGATAGTTTGACATTTAAAGAAGACATTCAAAAAGCA
CAAGTGTCTGGACAAGGCGATAGTTTACATGAACATATTGCAAATTTAGCTGGTA
GCCCTGCTATTAAAAAAGGTATTTTACAGACTGTAAAAGTTGTTGATGAATTGGT
CAAAGTAATGGGGCGGCATAAGCCAGAAAATATCGTTATTGAAATGGCACGTGA
AAATCAGACAACTCAAAAGGGCCAGAAAAATTCGCGAGAGCGTATGAAACGAAT
CGAAGAAGGTATCAAAGAATTAGGAAGTCAGATTCTTAAAGAGCATCCTGTTGA
AAATACTCAATTGCAAAATGAAAAGCTCTATCTCTATTATCTCCAAAATGGAAGA
GACATGTATGTGGACCAAGAATTAGATATTAATCGTTTAAGTGATTATGATGTCG
ATGCCATTGTTCCACAAAGTTTCCTTAAAGACGATTCAATAGACAATAAGGTCTT
AACGCGTTCTGATAAAAATCGTGGTAAATCGGATAACGTTCCAAGTGAAGAAGT
AGTCAAAAAGATGAAAAACTATTGGAGACAACTTCTAAACGCCAAGTTAATCACT
CAACGTAAGTTTGATAATTTAACGAAAGCTGAACGTGGAGGTTTGAGTGAACTTG
ATAAAGCTGGTTTTATCAAACGCCAATTGGTTGAAACTCGCCAAATCACTAAGCA
TGTGGCACAAATTTTGGATAGTCGCATGAATACTAAATACGATGAAAATGATAAA
CTTATTCGAGAGGTTAAAGTGATTACCTTAAAATCTAAATTAGTTTCTGACTTCCG
AAAAGATTTCCAATTCTATAAAGTACGTGAGATTAACAATTACCATCATGCCCAT
GATGCGTATCTAAATGCCGTCGTTGGAACTGCTTTGATTAAGAAATATCCAAAAC
TTGAATCGGAGTTTGTCTATGGTGATTATAAAGTTTATGATGTTCGTAAAATGATT
GCTAAGTCTGAGCAAGAAATAGGCAAAGCAACCGCAAAATATTTCTTTTACTCTA
ATATCATGAACTTCTTCAAAACAGAAATTACACTTGCAAATGGAGAGATTCGCAA
ACGCCCTCTAATCGAAACTAATGGGGAAACTGGAGAAATTGTCTGGGATAAAGG
GCGAGATTTTGCCACAGTGCGCAAAGTATTGTCCATGCCCCAAGTCAATATTGT
CAAGAAAACAGAAGTACAGACAGGCGGATTCTCCAAGGAGTCAATTTTACCAAA
AAGAAATTCGGACAAGCTTATTGCTCGTAAAAAAGACTGGGATCCAAAAAAATAT
GGTGGTTTTGATAGTCCAACGGTAGCTTATTCAGTCCTAGTGGTTGCTAAGGTG
GAAAAAGGGAAATCGAAGAAGTTAAAATCCGTTAAAGAGTTACTAGGGATCACA
ATTATGGAAAGAAGTTCCTTTGAAAAAAATCCGATTGACTTTTTAGAAGCTAAAG
GATATAAGGAAGTTAAAAAAGACTTAATCATTAAACTACCTAAATATAGTCTTTTT
GAGTTAGAAAACGGTCGTAAACGGATGCTGGCTAGTGCCGGAGAATTACAAAAA
GGAAATGAGCTGGCTCTGCCAAGCAAATATGTGAATTTTTTATATTTAGCTAGTC
ATTATGAAAAGTTGAAGGGTAGTCCAGAAGATAACGAACAAAAACAATTGTTTGT
GGAGCAGCATAAGCATTATTTAGATGAGATTATTGAGCAAATCAGTGAATTTTCT
AAGCGTGTTATTTTAGCAGATGCCAATTTAGATAAAGTTCTTAGTGCATATAACA
AACATAGAGACAAACCAATACGTGAACAAGCAGAAAATATTATTCATTTATTTAC
GTTGACGAATCTTGGAGCTCCCGCTGCTTTTAAATATTTTGATACAACAATTGAT

CGTAAACGATATACGTCTACAAAAGAAGTTTTAGATGCCACTCTTATCCATCAAT
CCATCACTGGTCTTTATGAAACACGCATTGATTTGAGTCAGCTAGGAGGTCCTA
GGGGAGGTGGCTCAGAAGGTGGCGGATCTGAAGGTGGCTCTGGAactagtATGA
GCGATAAAATTATTCACCTGACTGACGACAGTTTTGACACGGATGTACTCAAAGC
GGACGGGGCGATCCTCGTCGATTTCTGGGCAGAGTGGTGCGGTCCGTGCAAAA
TGATCGCCCCGATTCTGGATGAAATCGCTGACGAATATCAGGGCAAACTGACCG
TTGCAAAACTGAACATCGATCAAAACCCTGGCACTGCGCCGAAATATGGCATCC
GTGGTATCCCGACTCTGCTGCTGTTCAAAAACGGTGAAGTGGCGGCAACCAAA
GTGGGTGCACTGTCTAAAGGTCAGTTGAAAGAGTTCCTCGACGCTAACCTGGCC
GGTTCTGGTTCTGGCCATATGCACCATCATCATCATCATTCTTCTGGTCTGGTGC
CACGCGGTTCTGGTATGAAAGAAACCGCTGCTGCTAAATTCGAACGCCAGCACA
TGGACAGCCCAGATCTGGGTACCGACGACGACGACAAGGCCATGGCTGATATC
ggatccCATATGGAAATGATGCTCGATAAGAAACAGATTCGTGCGATCTTTCTCTTT
GAGTTTAAAATGGGTCGCAAAGCGGCGGAGACGACGCGTAATATTAACAACGC
GTTCGGTCCTGGCACCGCGAACGAGCGTACCGTGCAATGGTGGTTCAAAAAGT
TTCGCAAAGGCGACGAATCTCTGGAGGACGAAGAGCGTTCTGGCCGCCCGTCC
GAGGTTGACAACGACCAGCTGCGTGCAATCATCGAAGCTGATCCGCTGACTAC
CACCCGCGAAGTTGCTGAAGAACTGAATGTGGATCACTCTACTGTGGTTCGCCA
CCTGAAACAGATCGGTAAAGTAAAAAAACTGGACAAATGGGTTCCTCATGAACT
GTCTGAAAACCAGAAAAACCGTCGTTTCGAAGTTAGCTCCTCTCTGATTCTGCGT
AACAACAACGAACCGTTCCTGGATCGTATCGTAACCTGTGATGAGAAATGGATT
CTGTATGATAACCGTCGCCGCTCTGCTCAGTGGCTGGATCGCGAAGAAGCTCC
AAAACACTTCCCGAAACCGAATCTGCACCAGAAGAAAGTCATGGTAACCGTATG
GTGGTCTGCCGCAGGTGTTATCCACTATTCCTTCCTGAACCCGGGCGAAACTAT
CACCAGCGAAAAATACTGCCAGCAGATTGACGAAATGCACCGTAAACTGCAGCG
TCTGCAGCCAGCACTGGTGAATCGTAAAGGTCCGATCCTGCTGCATGATAACGC
CCGTCCGCACGTTGCCCAACCGACCCTGCAGAAACTGAACGAACTGGGCTATG
AAGTTCTGCCACACCCGCCGTACTCCCCGGATCTGTCCCCGACTGACTACCATT
TCTTCAAGCATCTGGACAACTTCCTGCAGGGTAAACGTTTTCACAACCAACAGG
ACGCAGAAAACGCTTTCCAGGAGTTCGTCGAAAGCCGTTCCACTGACTTCTACG
CGACCGGTATCAACAAGCTGATCAGCCGTTGGCAGAAATGCGTGGACTGTAAC
GGCAGCTACTTCGATTAAGACGTCTTAATAACTAAAAATATGGTATAATACTCTTA
ATAAATGCAGTAATACAGGGGCTTTTCAAGACTGAAGTCTAGCTGAGACAAATA
GTGCGATTACGAAATTTTTTAGACAAAAATAGTCTACGAGGTTTTAGAGCTATGC
TGTTTTGAATGGTCCCAAAACGGTTTTCCCAGTCACGACGTTGTAAAACGAGTTT
TAGAGCTATGCTGTTTTGAATGGTCCCAAAACTTCAGCACACTGAGACTTGTTGA
GTTCCATGTTTTAGAGCTATGCTGTTTTGAATGGACTCCATTCAACATTGCCGAT
GATAACTTGAGAAAGAGGGTTAATACCAGCAGTCGGATACCTTCCTATTCTTTCT
GTTAAAGCGTTTTCATGTTATAATAGGCAAAAGAAGAGTAGTGTGATCGTCCATT
CCGACAGCATCGCCAGTCACTATGGCGTGCTGCTAGCGCTATATGCGTTGATGC
AATTTCTATGCGCACCCGTTCTCGGAGCACTGTCCGACCGCTTTGGCCGCCGC
CCAGTCCTGCTCGCTTCGCTACTTGGAGCCACTATCGACTACGCGATCATGGCG
ACCACACCCGTCCTGTGGATCCTCTACGCCGGACGCATCGTGGCCGGCATCAC
CGGCGCCACAGGTGCGGTTGCTGGCGCCTATATCGCCGACATCACCGATGGGG

AAGATCGGGCTCGCCACTTCGGGCTCATGAGCGCTTGTTTCGGCGTGGGTATG
GTGGCAGGCCCCGTGGCCGGGGGACTGTTGGGCGCCATCTCCTTGCATGCAC
CATTCCTTGCGGCGGCGGTGCTCAACGGCCTCAACCTACTACTGGGCTGCTTC
CTAATGCAGGAGTCGCATAAGGGAGAGCGTCGACCGATGCCCTTGAGAGCCTT
CAACCCAGTCAGCTCCTTCCGGTGGGCGCGGGGCATGACTATCGTCGCCGCAC
TTATGACTGTCTTCTTTATCATGCAACTCGTAGGACAGGTGCCGGCAGCGCTCT
GGGTCATTTTCGGCGAGGACCGCTTTCGCTGGAGCGCGACGATGATCGGCCTG
TCGCTTGCGGTATTCGGAATCTTGCACGCCCTCGCTCAAGCCTTCGTCACTGGT
CCCGCCACCAAACGTTTCGGCGAGAAGCAGGCCATTATCGCCGGCATGGCGGC
CGACGCGCTGGGCTACGTCTTGCTGGCGTTCGCGACGCGAGGCTGGATGGCC
TTCCCCATTATGATTCTTCTCGCTTCCGGCGGCATCGGGATGCCCGCGTTGCAG
GCCATGCTGTCCAGGCAGGTAGATGACGACCATCAGGGACAGCTTCAAGGATC
GCTCGCGGCTCTTACCAGCCTAACTTCGATCATTGGACCGCTGATCGTCACGGC
GATTTATGCCGCCTCGGCGAGCACATGGAACGGGTTGGCATGGATTGTAGGCG
CCGCCCTATACCTTGTCTGCCTCCCCGCGTTGCGTCGCGGTGCATGGAGCCGG
GCCACCTCGACCTGAATGGAAGCCGGCGGCACCTCGCTAACGGATTCACCACT
CCAAGAATTGGAGCCAATCAATTCTTGCGGAGAACTGTGAATGCGCAAACCAAC
CCTTGGCAGAACATATCCATCGCGTCCGCCATCTCCAGCAGCCGCACGCGGCG
CATCTCGGGCAGCGTTGGGTCCTGGCCACGGGTGCGCATGATCGTGCTCCTGT
CGTTGAGGACCCGGCTAGGCTGGCGGGGTTGCCTTACTGGTTAGCAGAATGAA
TCACCGATACGCGAGCGAACGTGAAGCGACTGCTGCTGCAAAACGTCTGCGAC
CTGAGCAACAACATGAATGGTCTTCGGTTTCCGTGTTTCGTAAAGTCTGGAAAC
GCGGAAGTCCCCTACGTGCTGCTGAAGTTGCCCGCAACAGAGAGTGGAACCAA
CCGGTGATACCACGATACTATGACTGAGAGTCAACGCCATGAGCGGCCTCATTT
CTTATTCTGAGTTACAACAGTCCGCACCGCTGTCCGGTAGCTCCTTCCGGTGGG
CGCGGGGCATGACTATCGTCGCCGCACTTATGACTGTCTTCTTTATCATGCAAC
TCGTAGGACAGGTGCCGGCAGCGCCCAACAGTCCCCCGGCCACGGGGCCTGC
CACCATACCCACGCCGAAACAAGCGCCCTGCACCATTATGTTCCGGATCTGCAT
CGCAGGATGCTGCTGGCTACCCTGTGGAACACCTACATCTGTATTAACGAAGCG
CTAACCGTTTTTATCAGGCTCTGGGAGGCAGAATAAATGATCATATCGTCAATTA
TTACCTCCACGGGGAGAGCCTGAGCAAACTGGCCTCAGGCATTTGAGAAGCAC
ACGGTCACACTGCTTCCGGTAGTCAATAAACCGGTAAACCAGCAATAGACATAA
GCGGCTATTTAACGACCCTGCCCTGAACCGACGACCGGGTCGAATTTGCTTTCG
AATTTCTGCCATTCATCCGCTTATTATCACTTATTCAGGCGTAGCACCAGGCGTT
TAAGGGCACCAATAACTGCCTTAAAAAAATTACGCCCCGCCCTGCCACTCATCG
CAGTACTGTTGTAATTCATTAAGCATTCTGCCGACATGGAAGCCATCACAGACG
GCATGATGAACCTGAATCGCCAGCGGCATCAGCACCTTGTCGCCTTGCGTATAA
TATTTGCCCATGGTGAAAACGGGGGCGAAGAAGTTGTCCATATTGGCCACGTTT
AAATCAAAACTGGTGAAACTCACCCAGGGATTGGCTGAGACGAAAAACATATTC
TCAATAAACCCTTTAGGGAAATAGGCCAGGTTTTCACCGTAACACGCCACATCTT
GCGAATATATGTGTAGAAACTGCCGGAAATCGTCGTGGTATTCACTCCAGAGCG
ATGAAAACGTTTCAGTTTGCTCATGGAAAACGGTGTAACAAGGGTGAACACTAT
CCCATATCACCAGCTCACCGTCTTTCATTGCCATACG

pRC2311

TTTCTCTGTCCTTCCTGTGCGACGGTTACGCCGCTCCATGAGCTTATCGCGAAT
AAATACCTGTGACGGAAGATCACTTCGCAGAATAAATAAATCCTGGTGTCCCTGT
TGATACCGGGAAGCCCTGGGCCAACTTTTGGCGAAAATGAGACGTTGATCGGC
ACGTAAGAGGTTCCAACTTTCACCATAATGAAATAAGATCACTACCGGGCGTATT
TTTTGAGTTATCGAGATTTTCAGGAGCTAAGGAAGCTAAAATGGAGAAAAAAATC
ACTGGATATACCACCGTTGATATATCCCAATGGCATCGTAAAGAACATTTTGAGG
CATTTCAGTCAGTTGCTCAATGTACCTATAACCAGACCGTTCAGCTGGATATTAC
GGCCTTTTTAAAGACCGTAAAGAAAAATAAGCACAAGTTTTATCCGGCCTTTATT
CACATTCTTGCCCGCCTGATGAATGCTCATCCGGAGTTCCGTATGGCAATGAAA
GACGGTGAGCTGGTGATATGGGATAGTGTTCACCCTTGTTACACCGTTTTCCAT
GAGCAAACTGAAACGTTTTCATCGCTCTGGAGTGAATACCACGACGATTTCCGG
CAGTTTCTACACATATATTCGCAAGATGTGGCGTGTTACGGTGAAAACCTGGCC
TATTTCCCTAAAGGGTTTATTGAGAATATGTTTTTCGTCTCAGCCAATCCCTGGG
TGAGTTTCACCAGTTTTGATTTAAACGTGGCCAATATGGACAACTTCTTCGCCCC
CGTTTTCACCATGGGCAAATATTATACGCAAGGCGACAAGGTGCTGATGCCGCT
GGCGATTCAGGTTCATCATGCCGTTTGTGATGGCTTCCATGTCGGCAGAATGCT
TAATGAATTACAACAGTACTGCGATGAGTGGCAGGGCGGGGCGTAATTTTTTTA
AGGCAGTTATTGGTGCCCTTAAACGCCTGGTTGCTACGCCTGAATAAGTGATAA
TAAGCGGATGAATGGCAGAAATTCGATGATAAGCTGTCAAACATGAGAATTGGT
CGACGGCGCGCCAAAGCTTGCATGCCTGCAGCCGCGTAACCTGGCAAAATCGG
TTACGGTTGAGTAATAAATGGATGCCCTGCGTAAGCGGGGCACATTTCATTACC
TCTTTCTCCGCACCCGACATAGATAATAACTTCGTATAGTATACATTATACGAAG
TTATCTAGTAGACTTAATTAAGGATCGATCCGGCGCGCCAATAGTCATGCCCCG
CGCCCACCGGAAGGAGCTGACTGGGTTGAAGGCTCTCAAGGGCATCGGTCGA
GCTTGACATTGTAGGACTATATTGCTCTAATAAATTTGCGGCCGCTAATACGACT
CACTATAGGGAGAGGATCCGCGGGATTACGAAATCATCCTGTGGAGCTTAGTAG
GTTTAGCAAGATGGCAGCGCCTAAATGTAGAATGATAAAAGGATTAAGAGATTA
ATTTCCCTAAAAATGATAAAACAAGCGTTTTGAAAGCGCTTGTTTTTTTGGTTTGC
AGTCAGAGTAGAATAGAAGTATCAAAAAAAGCACCGACTCGGTGCCACTTTTTC
AAGTTGATAACGGACTAGCCTTATTTTAACTTGCTATGCTGTTTTGAATGGTTCC
AACAAGATTATTTTATAACTTTTATAACAAATAATCAAGGAGAAATTCAAAGAAAT
TTATCAGCCATAAAACAATACTTAATACTATAGAATGATAACAAAATAAACTACTT
TTTAAAAGAATTTTGTGTTATAATCTATTTATTATTAAGTATTGGGTAATATTTTTT
GAAGAGCGGCCGCGTTAATAACAGGGGACGTGGTAATCCGTCCCCTTTTTATTT
CTGACTGAGTTAATAACAGGCCTGCTTCGGCAGGCCTTTTTATTTCTGACTGAGT
TCTTCTCAGGCCTGCTGGTAATCGCAGGCCTTTTTATTTTCTAGTCTGACTGACT
GACTGACTGACTGACTGACTGACTGACTGACTGACTGACTGACTGACTGACTGA
CTGACTGACTGACTGACTGACTGACTGACTGACTGACTGACTGACTGACTGACT
GACTGACTGACTGACTGACTGACTGACTGACTGACTGACTGACTGACTGACTGA
CTGACTGACCTCGAGATGGATAAGAAATACTCAATAGGCTTAGCTATCGGCACA
AATAGCGTCGGATGGGCGGTGATCACTGATGAATATAAGGTTCCGTCTAAAAAG
TTCAAGGTTCTGGGAAATACAGACCGCCACAGTATCAAAAAAAATCTTATAGGG
GCTCTTTTATTTGACAGTGGAGAGACAGCGGAAGCGACTCGTCTCAAACGGACA

GCTCGTAGAAGGTATACACGTCGGAAGAATCGTATTTGTTATCTACAGGAGATTT
TTTCAAATGAGATGGCGAAAGTAGATGATAGTTTCTTTCATCGACTTGAAGAGTC
TTTTTTGGTGGAAGAAGACAAGAAGCATGAACGTCATCCTATTTTTGGAAATATA
GTAGATGAAGTTGCTTATCATGAGAAATATCCAACTATCTATCATCTGCGAAAAA
AATTGGTAGATTCTACTGATAAAGCGGATTTGCGCTTAATCTATTTGGCCTTAGC
GCATATGATTAAGTTTCGTGGTCATTTTTTGATTGAGGGAGATTTAAATCCTGAT
AATAGTGATGTGGACAAACTATTTATCCAGTTGGTACAAACCTACAATCAATTATT
TGAAGAAAACCCTATTAACGCAAGTGGAGTAGATGCTAAAGCGATTCTTTCTGCA
CGATTGAGTAAATCAAGACGATTAGAAAATCTCATTGCTCAGCTCCCCGGTGAG
AAGAAAAATGGCTTATTTGGGAATCTCATTGCTTTGTCATTGGGTTTGACCCCTA
ATTTTAAATCAAATTTTGATTTGGCAGAAGATGCTAAATTACAGCTTTCAAAAGAT
ACTTACGATGATGATTTAGATAATTTATTGGCGCAAATTGGAGATCAATATGCTG
ATTTGTTTTTGGCAGCTAAGAATTTATCAGATGCTATTTTACTTTCAGATATCCTA
AGAGTAAATACTGAAATAACTAAGGCTCCCCTATCAGCTTCAATGATTAAACGCT
ACGATGAACATCATCAAGACTTGACTCTTTTAAAAGCTTTAGTTCGACAACAACT
TCCAGAAAAGTATAAAGAAATCTTTTTTGATCAATCAAAAAACGGATATGCAGGT
TATATTGATGGGGGAGCTAGCCAAGAAGAATTTTATAAATTTATCAAACCAATTTT
AGAAAAAATGGATGGTACTGAGGAATTATTGGTGAAACTAAATCGTGAAGATTTG
CTGCGCAAGCAACGGACCTTTGACAACGGCTCTATTCCCCATCAAATTCACTTG
GGTGAGCTGCATGCTATTTTGAGAAGACAAGAAGACTTTTATCCATTTTTAAAAG
ACAATCGTGAGAAGATTGAAAAAATCTTGACTTTTCGAATTCCTTATTATGTTGGT
CCATTGGCGCGTGGCAATAGTCGTTTTGCATGGATGACTCGGAAGTCTGAAGAA
ACAATTACCCCATGGAATTTTGAAGAAGTTGTCGATAAAGGTGCTTCAGCTCAAT
CATTTATTGAACGCATGACAAACTTTGATAAAAATCTTCCAAATGAAAAAGTACTA
CCAAAACATAGTTTGCTTTATGAGTATTTTACGGTTTATAACGAATTGACAAAGGT
CAAATATGTTACTGAAGGAATGCGAAAACCAGCATTTCTTTCAGGTGAACAGAA
GAAAGCCATTGTTGATTTACTCTTCAAAACAAATCGAAAAGTAACCGTTAAGCAA
TTAAAAGAAGATTATTTCAAAAAAATAGAATGTTTTGATAGTGTTGAAATTTCAGG
AGTTGAAGATAGATTTAATGCTTCATTAGGTACCTACCATGATTTGCTAAAAATTA
TTAAAGATAAAGATTTTTTGGATAATGAAGAAAATGAAGATATCTTAGAGGATATT
GTTTTAACATTGACCTTATTTGAAGATAGGGAGATGATTGAGGAAAGACTTAAAA
CATATGCTCACCTCTTTGATGATAAGGTGATGAAACAGCTTAAACGTCGCCGTTA
TACTGGTTGGGGACGTTTGTCTCGAAAATTGATTAATGGTATTAGGGATAAGCAA
TCTGGCAAAACAATATTAGATTTTTTGAAATCAGATGGTTTTGCCAATCGCAATTT
TATGCAGCTGATCCATGATGATAGTTTGACATTTAAAGAAGACATTCAAAAAGCA
CAAGTGTCTGGACAAGGCGATAGTTTACATGAACATATTGCAAATTTAGCTGGTA
GCCCTGCTATTAAAAAAGGTATTTTACAGACTGTAAAAGTTGTTGATGAATTGGT
CAAAGTAATGGGGCGGCATAAGCCAGAAAATATCGTTATTGAAATGGCACGTGA
AAATCAGACAACTCAAAAGGGCCAGAAAAATTCGCGAGAGCGTATGAAACGAAT
CGAAGAAGGTATCAAAGAATTAGGAAGTCAGATTCTTAAAGAGCATCCTGTTGA
AAATACTCAATTGCAAAATGAAAAGCTCTATCTCTATTATCTCCAAAATGGAAGA
GACATGTATGTGGACCAAGAATTAGATATTAATCGTTTAAGTGATTATGATGTCG
ATGCCATTGTTCCACAAAGTTTCCTTAAAGACGATTCAATAGACAATAAGGTCTT
AACGCGTTCTGATAAAAATCGTGGTAAATCGGATAACGTTCCAAGTGAAGAAGT

AGTCAAAAAGATGAAAAACTATTGGAGACAACTTCTAAACGCCAAGTTAATCACT
CAACGTAAGTTTGATAATTTAACGAAAGCTGAACGTGGAGGTTTGAGTGAACTTG
ATAAAGCTGGTTTTATCAAACGCCAATTGGTTGAAACTCGCCAAATCACTAAGCA
TGTGGCACAAATTTTGGATAGTCGCATGAATACTAAATACGATGAAAATGATAAA
CTTATTCGAGAGGTTAAAGTGATTACCTTAAAATCTAAATTAGTTTCTGACTTCCG
AAAAGATTTCCAATTCTATAAAGTACGTGAGATTAACAATTACCATCATGCCCAT
GATGCGTATCTAAATGCCGTCGTTGGAACTGCTTTGATTAAGAAATATCCAAAAC
TTGAATCGGAGTTTGTCTATGGTGATTATAAAGTTTATGATGTTCGTAAAATGATT
GCTAAGTCTGAGCAAGAAATAGGCAAAGCAACCGCAAAATATTTCTTTTACTCTA
ATATCATGAACTTCTTCAAAACAGAAATTACACTTGCAAATGGAGAGATTCGCAA
ACGCCCTCTAATCGAAACTAATGGGGAAACTGGAGAAATTGTCTGGGATAAAGG
GCGAGATTTTGCCACAGTGCGCAAAGTATTGTCCATGCCCCAAGTCAATATTGT
CAAGAAAACAGAAGTACAGACAGGCGGATTCTCCAAGGAGTCAATTTTACCAAA
AAGAAATTCGGACAAGCTTATTGCTCGTAAAAAAGACTGGGATCCAAAAAAATAT
GGTGGTTTTGATAGTCCAACGGTAGCTTATTCAGTCCTAGTGGTTGCTAAGGTG
GAAAAAGGGAAATCGAAGAAGTTAAAATCCGTTAAAGAGTTACTAGGGATCACA
ATTATGGAAAGAAGTTCCTTTGAAAAAAATCCGATTGACTTTTTAGAAGCTAAAG
GATATAAGGAAGTTAAAAAAGACTTAATCATTAAACTACCTAAATATAGTCTTTTT
GAGTTAGAAAACGGTCGTAAACGGATGCTGGCTAGTGCCGGAGAATTACAAAAA
GGAAATGAGCTGGCTCTGCCAAGCAAATATGTGAATTTTTTATATTTAGCTAGTC
ATTATGAAAAGTTGAAGGGTAGTCCAGAAGATAACGAACAAAAACAATTGTTTGT
GGAGCAGCATAAGCATTATTTAGATGAGATTATTGAGCAAATCAGTGAATTTTCT
AAGCGTGTTATTTTAGCAGATGCCAATTTAGATAAAGTTCTTAGTGCATATAACA
AACATAGAGACAAACCAATACGTGAACAAGCAGAAAATATTATTCATTTATTTAC
GTTGACGAATCTTGGAGCTCCCGCTGCTTTTAAATATTTTGATACAACAATTGAT
CGTAAACGATATACGTCTACAAAAGAAGTTTTAGATGCCACTCTTATCCATCAAT
CCATCACTGGTCTTTATGAAACACGCATTGATTTGAGTCAGCTAGGAGGTCCTA
GGGGAGGTGGCTCAGAAGGTGGCGGATCTGAAGGTGGCTCTGGAACTAGTATG
AGCGATAAAATTATTCACCTGACTGACGACAGTTTTGACACGGATGTACTCAAAG
CGGACGGGGCGATCCTCGTCGATTTCTGGGCAGAGTGGTGCGGTCCGTGCAAA
ATGATCGCCCCGATTCTGGATGAAATCGCTGACGAATATCAGGGCAAACTGACC
GTTGCAAAACTGAACATCGATCAAAACCCTGGCACTGCGCCGAAATATGGCATC
CGTGGTATCCCGACTCTGCTGCTGTTCAAAAACGGTGAAGTGGCGGCAACCAAA
GTGGGTGCACTGTCTAAAGGTCAGTTGAAAGAGTTCCTCGACGCTAACCTGGCC
GGTTCTGGTTCTGGCCATATGCACCATCATCATCATCATTCTTCTGGTCTGGTGC
CACGCGGTTCTGGTATGAAAGAAACCGCTGCTGCTAAATTCGAACGCCAGCACA
TGGACAGCCCAGATCTGGGTACCGACGACGACGACAAGGCCATGGCTGATATC
GGATCCCATATGGAAATGATGCTCGATAAGAAACAGATTCGTGCGATCTTTCTCT
TTGAGTTTAAAATGGGTCGCAAAGCGGCGGAGACGACGCGTAATATTAACAACG
CGTTCGGTCCTGGCACCGCGAACGAGCGTACCGTGCAATGGTGGTTCAAAAAG
TTTCGCAAAGGCGACGAATCTCTGGAGGACGAAGAGCGTTCTGGCCGCCCGTC
CGAGGTTGACAACGACCAGCTGCGTGCAATCATCGAAGCTGATCCGCTGACTA
CCACCCGCGAAGTTGCTGAAGAACTGAATGTGGATCACTCTACTGTGGTTCGCC
ACCTGAAACAGATCGGTAAAGTAAAAAAACTGGACAAATGGGTTCCTCATGAAC

TGTCTGAAAACCAGAAAAACCGTCGTTTCGAAGTTAGCTCCTCTCTGATTCTGCG
TAACAACAACGAACCGTTCCTGGATCGTATCGTAACCTGTGATGAGAAATGGAT
TCTGTATGATAACCGTCGCCGCTCTGCTCAGTGGCTGGATCGCGAAGAAGCTCC
AAAACACTTCCCGAAACCGAATCTGCACCAGAAGAAAGTCATGGTAACCGTATG
GTGGTCTGCCGCAGGTGTTATCCACTATTCCTTCCTGAACCCGGGCGAAACTAT
CACCAGCGAAAAATACTGCCAGCAGATTGACGAAATGCACCGTAAACTGCAGCG
TCTGCAGCCAGCACTGGTGAATCGTAAAGGTCCGATCCTGCTGCATGATAACGC
CCGTCCGCACGTTGCCCAACCGACCCTGCAGAAACTGAACGAACTGGGCTATG
AAGTTCTGCCACACCCGCCGTACTCCCCGGATCTGTCCCCGACTGACTACCATT
TCTTCAAGCATCTGGACAACTTCCTGCAGGGTAAACGTTTTCACAACCAACAGG
ACGCAGAAAACGCTTTCCAGGAGTTCGTCGAAAGCCGTTCCACTGACTTCTACG
CGACCGGTATCAACAAGCTGATCAGCCGTTGGCAGAAATGCGTGGACTGTAAC
GGCAGCTACTTCGATTAAGACGTCTTAATAACTAAAAATATGGTATAATACTCTTA
ATAAATGCAGTAATACAGGGGCTTTTCAAGACTGAAGTCTAGCTGAGACAAATA
GTGCGATTACGAAATTTTTTAGACAAAAATAGTCTACGAGGTTTTAGAGCTATGC
TGTTTTGAATGGTCCCAAAACGGTTTTCCCAGTCACGACGTTGTAAAACGAGTTT
TAGAGCTATGCTGTTTTGAATGGTCCCAAAACTTCAGCACACTGAGACTTGTTGA
GTTCCATGTTTTAGAGCTATGCTGTTTTGAATGGACTCCATTCAACATTGCCGAT
GATAACTTGAGAAAGAGGGTTAATACCAGCAGTCGGATACCTTCCTATTCTTTCT
GTTAAAGCGTTTTCATGTTATAATAGGCAAAAGAAGAGTAGTGTGATCGCCGCG
GATCCTTCTATAGTGTCACCTAAATGTCGACGGCCAGGCGGCCGCCAGGCCTA
CCCACTAGTCAATTCGGGAGGATCGAAACGGCAGATCGCAAAAAACAGTACATA
CAGAAGGAGACATGAACATGAACATCAAAAAAATTGTAAAACAAGCCACAGTTCT
GACTTTTACGACTGCACTTCTGGCAGGAGGAGCGACTCAAGCCTTCGCGAAAGA
AAATAACCAAAAAGCATACAAAGAAACGTACGGCGTCTCTCATATTACACGCCAT
GATATGCTGCAGATCCCTAAACAGCAGCAAAACGAAAAATACCAAGTGCCTCAA
TTCGATCAATCAACGATTAAAAATATTGAGTCTGCAAAAGGACTTGATGTGTGGG
ACAGCTGGCCGCTGCAAAACGCTGACGGAACAGTAGCTGAATACAACGGCTAT
CACGTTGTGTTTGCTCTTGCGGGAAGCCCGAAAGACGCTGATGACACATCAATC
TACATGTTTTATCAAAAGGTCGGCGACAACTCAATCGACAGCTGGAAAAACGCG
GGCCGTGTCTTTAAAGACAGCGATAAGTTCGACGCCAACGATCCGATCCTGAAA
GATCAGACGCAAGAATGGTCCGGTTCTGCAACCTTTACATCTGACGGAAAAATC
CGTTTATTCTACACTGACTATTCCGGTAAACATTACGGCAAACAAAGCCTGACAA
CAGCGCAGGTAAATGTGTCAAAATCTGATGACACACTCAAAATCAACGGAGTGG
AAGATCACAAAACGATTTTTGACGGAGACGGAAAAACATATCAGAACGTTCAGC
AGTTTATCGATGAAGGCAATTATACATCCGGCGACAACCATACGCTGAGAGACC
CTCACTACGTTGAAGACAAAGGCCATAAATACCTTGTATTCGAAGCCAACACGG
GAACAGAAAACGGATACCAAGGCGAAGAATCTTTATTTAACAAAGCGTACTACG
GCGGCGGCACGAACTTCTTCCGTAAAGAAAGCCAGAAGCTTCAGCAGAGCGCT
AAAAAACGCGATGCTGAGTTAGCGAACGGCGCCCTCGGTATCATAGAGTTAAAT
AATGATTACACATTGAAAAAAGTAATGAAGCCGCTGATCACTTCAAACACGGTAA
CTGATGAAATCGAGCGCGCGAATGTTTTCAAAATGAACGGCAAATGGTACTTGT
TCACTGATTCACGCGGTTCAAAAATGACGATCGATGGTATTAACTCAAACGATAT
TTACATGCTTGGTTATGTATCAAACTCTTTAACCGGCCCTTACAAGCCGCTGAAC

AAAACAGGGCTTGTGCTGCAAATGGGTCTTGATCCAAACGATGTGACATTCACT
TACTCTCACTTCGCAGTGCCGCAAGCCAAAGGCAACAATGTGGTTATCACAAGC
TACATGACAAACAGAGGCTTCTTCGAGGATAAAAAGGCAACATTTGCGCCAAGC
TTCTTAATGAACATCAAAGGCAATAAAACATCCGTTGTCAAAAACAGCATCCTGG
AGCAAGGACAGCTGACAGTCAACTAATAACAGCAAAAAGAAAATGCCGATACTT
CATTGGCATTTTCTTTTATTTCTCAACAAGATGGTGAATTGACTAGTGGGTAGAT
CCACAGGACGGGTGTGGTCGCCATGATCGCGTAGTCGATAGTGGCTCCAAGTA
GCGAAGCGAGCAGGACTGGGCGGCGGCCAAAGCGGTCGGACAGTGCTCCGAG
AACGGGTGCGCATAGAAATTGCATCAACGCATATAGCGCTAGCAGCACGCCATA
GTGACTGGCGATGCTGTCGGAATGGACGATATCCCGCAAGAGGCCCGGCAGTA
CCGGCATAACCAAGCCTATGCCTACAGCATCCAGGGTGACGGTGCCGAGGATG
ACGATGAGCGCATTGTTAGATTTCATACACGGTGCCTGACTGCGTTAGCAATTTA
ACTGTGATAAACTACCGCATTAAAGCTTATCGATGATAAGCTGTCAAACATGAGA
ATTGATCCGGAACCCTTAATATAACTTCGTATAATGTATGCTATACGAAGTTATTA
GGTCCCTCGACTATAGGGTCACCGTCGACAGCGACACACTTGCATCGGATGCA
GCCCGGTTAACGTGCCGGCACGGCCTGGGTAACCAGGTATTTTGTCCACATAA
CCGTGCGCAAAATGTTGTGGATAAGCAGGACACAGCAGCAATCCACAGCAGGC
ATACAACCGCACACCGAGGTTACTCCGTTCTACAGGTTACGACGACATGTCAAT
ACTTGCCCTTGACAGGCATTGATGGAATCGTAGTCTCACGCTGATAGTCTGATC
GACAATACAAGTGGGACCGTGGTCCCAGACCGATAATCAGACCGACAACACGA
GTGGGATCGTGGTCCCAGACTAATAATCAGACCGACGATACGAGTGGGACCGT
GGTCCCAGACTAATAATCAGACCGACGATACGAGTGGGACCGTGGTTCCAGAC
TAATAATCAGACCGACGATACGAGTGGGACCGTGGTCCCAGACTAATAATCAGA
CCGACGATACGAGTGGGACCATGGTCCCAGACTAATAATCAGACCGACGATAC
GAGTGGGACCGTGGTCCCAGTCTGATTATCAGACCGACGATACGAGTGGGACC
GTGGTCCCAGACTAATAATCAGACCGACGATACGAGTGGGACCGTGGTCCCAG
ACTAATAATCAGACCGACGATACGAGTGGGACCGTGGTCCCAGTCTGATTATCA
GACCGACGATACAAGTGGAACAGTGGGCCCAGAGAGAATATTCAGGCCAGTTA
TGCTTTCTGGCCTGTAACAAAGGACATTAAGTAAAGACAGATAAACGTAGACTAA
AACGTGGTCGCATCAGGGTGCTGGCTTTTCAAGTTCCTTAAGAATGGCCTCAAT
TTTCTCTATACACTCAGTTGGAACACGAGACCTGTCCAGGTTAAGCACCATTTTA
TCGCCCTTATACAATACTGTCGCTCCAGGAGCAAACTGATGTCGTGAGCTTAAA
CTAGTTCTTGATGCAGATGACGTTTTAAGCACAGAAGTTAAAAGAGTGATAACTT
CTTCAGCTTCAAATATCACCCCAGCTTTTTTCTGCTCATGAAGGTTAGATGCCTG
CTGCTTAAGTAATTCCTCTTTATCTGTAAAGGCTTTTTGAAGTGCATCACCTGAC
CGGGCAGATAGTTCACCGGGGTGAGAAAAAAGAGCAACAACTGATTTAGGCAAT
TTGGCGGTGTTGATACAGCGGGTAATAATCTTACGTGAAATATTTTCCGCATCAG
CCAGCGCAGAAATATTTCCAGCAAATTCATTCTGCAATCGGCTTGCATAACGCT
GACCACGTTCATAAGCACTTGTTGGGCGATAATCGTTACCCAATCTGGATAATG
CAGCCATCTGCTCATCATCCAGCTCGCCAACCAGAACACGATAATCACTTTCGG
TAAGTGCAGCAGCTTTACGACGGCGACTCCCATCGGCAATTTCTATGACACCAG
ATACTCTTCGACCGAACGCCGGTGTCTGTTGACCAGTCAGTAGAAAAGAAGGGA
TGAGATCATCCAGTGCGTCCTCAGTAAGCAGCTCCTGGTCACGTTCATTACCTG
ACCATACCCGAGAGGTCTTCTCAACACTATCACCCCGGAGCACTTCAAGAGTAA

ACTTCACATCCCGACCACATACAGGCAAAGTAATGGCATTACCGCGAGCCATTA
CTCCTACGCGCGCAATTAACGAATCCACCATCGGGGCAGCTGGTGTCGATAAC
GAAGTATCTTCAACCGGTTGAGTATTGAGCGTATGTTTTGGAATAACAGGCGCA
CGCTTCATTATCTAATCTCCCAGCGTGGTTTAATCAGACGATCGAAAATTTCATT
GCAGACAGGTTCCCAAATAGAAAGAGCATTTCTCCAGGCACCAGTTGAAGAGCG
TTGATCAATGGCCTGTTCAAAAACAGTTCTCATCCGGATCTGACCTTTACCAACT
TCATCCGTTTCACGTACAACATTTTTTAGAACCATGCTTCCCCAGGCATCCCGAA
TTTGCTCCTCCATCCACGGGGACTGAGAGCCATTACTATTGCTGTATTTGGTAA
GCAAAATACGTACATCAGGCTCGAACCCTTTAAGATCAACGTTCTTGAGCAGAT
CACGAAGCATATCGAAAAACTGCAGTGCGGAGGTGTAGTCAAACAACTCAGCAG
GCGTGGGAACAATCAGCACATCAGCAGCACATACGACATTAATCGTGCCGATAC
CCAGGTTAGGCGCGCTGTCAATAACTATGACATCATAGTCATGAGCAACAGTTT
CAATGGCCAGTCGGAGCATCAGGTGTGGATCGGTGGGCAGTTTACCTTCATCAA
ATTTGCCCATTAACTCAGTTTCAATACGGTGCAGAGCCAGACAGGAAGGAATAA
TGTCAAGCCCCGGCCAGCAAGTGGGCTTTATTGCATAAGTGACATCGTCCTTTT
CCCCAAGATAGAAAGGCAGGAGAGTGTCTTCTGCATGAATATGAAGATCTGGTA
CCCATCCGTGATACATTGAGGCTGTTCCCTGGGGGTCGTTACCTTCCACGAGCA
AAACACGTAGCCCCTTCAGAGCCAGATCCTGAGCAAGATGAACAGAAACTGAG
GTTTTGTAAACGCCACCTTTATGGGCAGCAACCCCGATCACCGGTGGAAATACG
TCTTCAGCACGTCGCAATCGCGTACCAAACACATCACGCATATGATTAATTTGTT
CAATTGTATAACCAACACGTTGCTCAACCCGTCCTCGAATTTCCATATCCGGGTG
CGGTAGTCGCCCTGCTTTCTCGGCATCTCTGATAGCCTGAGAAGAAACCCCAAC
TAAATCCGCTGCTTCACCTATTCTCCAGCGCCGGGTTATTTTCCTCGCTTCCGG
GCTGTCATCATTAAACTGTGCAATGGCGATAGCCTTCGTCATTTCATGACCAGC
GTTTATGCACTGGTTAAGTGTTTCCATGAGTTTCATTCTGAACATCCTTTAATCAT
TGCTTTGCGTTTTTTTATTAAATCTTGCAATTTACTGCAAAGCAACAACAAAATCG
CAAAGTCATCAAAAAACCGCAAAGTTGTTTAAAATAAGAGCAACACTACAAAAGG
AGATAAGAAGAGCACATACCTCAGTCACTTATTATCACTAGCGCTCGCCGCAGC
CGTGTAACCGAGCATAGCGAGCGAACTGGCGAGGAAGCAAAGAAGAACTGTTC
TGTCAGATAGCTCTTACGCTCAGCGCAAGAAGAAATATCCACCGTGGGAAAAAC
TCCAGGTAGAGGTACACACGCGGATAGCCAATTCAGAGTAATAAACTGTGATAA
TCAACCCTCATCAATGATGACGAACTAACCCCCGATATCAGGTCACATGACGAA
GGGAAAGAGAAGGAAATCAACTGTGACAAACTGCCCTCAAATTTGGCTTCCTTA
AAAATTACAGTTCAAAAAGTATGAGAAAATCCATGCAGGCTGAAGGAAACAGCA
AAACTGTGACAAATTACCCTCAGTAGGTCAGAACAAATGTGACGAACCACCCTC
AAATCTGTGACAGATAACCCTCAGACTATCCTGTCGTCATGGAAGTGATATCGC
GGAAGGAAAATACGATATGAGTCGTCTGGCGGCCTTTCTTTTTCTCAATGTATGA
GAGGCGCATTGGAGTTCTGCTGTTGATCTCATTAACACAGACCTGCAGGAAGCG
GCGGCGGAAGTCAGGCATACGCTGGTAACTTTGAGGCAGCTGGTAACGCTCTA
TGATCCAGTCGATTTTCAGAGAGACGATGCCTGAGCCATCCGGCTTACGATACT
GACACAGGGATTCGTATAAACGCATGGCATACGGATTGGTGATTTCTTTTGTTTC
ACTAAGCCGAAACTGCGTAAACCGGTTCTGTAACCCGATAAAGAAGGGAATGAG
ATATGGGTTGATATGTACACTGTAAAGCCCTCTGGATGGACTGTGCGCACGTTT
GATAAACCAAGGAAAAGATTCATAGCCTTTTTCATCGCCGGCATCCTCTTCAGG

GCGATAAAAAACCACTTCCTTCCCCGCGAAACTCTTCAATGCCTGCCGTATATC
CTTACTGGCTTCCGCAGAGGTCAATCCGAATATTTCAGCATATTTAGCAACATGG
ATCTCGCAGATACCGTCATGTTCCTGTAGGGTGCCATCAGATTTTCTGATCTGGT
CAACGAACAGATACAGCATACGTTTTTGATCCCGGGAGAGACTATATGCCGCCT
CAGTGAGGTCGTTTGACTGGACGATTCGCGGGCTATTTTTACGTTTCTTGTGATT
GATAACCGCTGTTTCCGCCATGACAGATCCATGTGAAGTGTGACAAGTTTTTAG
ATTGTCACACTAAATAAAAAAGAGTCAATAAGCAGGGATAACTTTGTGAAAAAAC
AGCTTCTTCTGAGGGCAATTTGTCACAGGGTTAAGGGCAATTTGTCACAGACAG
GACTGTCATTTGAGGGTGATTTGTCACACTGAAAGGGCAATTTGTCACAACACC
TTCTCTAGAACCAGCATGGATAAAGGCCTACAAGGCGCTCTAAAAAAGAAGATC
TAAAAACTATAAAAAAAATAATTATAAAAATATCCCCGTGGATAAGTGGATAACC
CCAAGGGAAGTTTTTTCAGGCATCGTGTGTAAGCAGAATATATAAGTGCTGTTCC
CTGGTGCTTCCTCGCTCACTCGAGGGCTTCGCCCTGTCGCTCAACTGCGGCGA
GCACTACTGGCTGTAAAAGGACAGACCACATCATGGTTCTGTGTTCATTAGGTT
GTTCTGTCCATTGCTGACATAATCCGCTCCACTTCAACGTAACACCGCACGAAG
ATTTCTATTGTTCCTGAAGGCATATTCAAATCGTTTTCGTTACCGCTTGCAGGCA
TCATGACAGAACACTACTTCCTATAAACGCTACACAGGCTCCTGAGATTAATAAT
GCGGATCTCTACGATAATGGGAGATTTTCCCGACTGTTTCGTTCGCTTCTCAGT
GGATAACAGCCAGCTTCTCTGTTTAACAGACAAAAACAGCATATCCACTCAGTTC
CACATTTCCATATAAAGGCCAAGGCATTTATTCTCAGGATAATTGTTTCAGCATC
GCAACCGCATCAGACTCCGGCATCGCAAACTGCACCCGGTGCCGGGCAGCCAC
ATCCAGCGCAAAAACCTTCGTGTAGACTTCCGTTGAACTGATGGACTTATGTCC
CATCAGGCTTTGCAGAACTTTCAGCGGTATACCGGCATACAGCATGTGCATCGC
ATAGGAATGGCGGAACGTATGTGGTGTGACCGGAACAGAGAACGTCACACCGT
CAGCAGCAGCGGCGGCAACCGCCTCCCCAATCCAGGTCCTGACCGTTCTGTCC
GTCACTTCCCAGATCCGCGC

pRC2312

GGTCGGGCTGAACGGGGGGTTCGTGCACACAGCCCAGCTTGGAGCGAACGAC
CTACACCGAACTGAGATACCTACAGCGTGAGCTATGAGAAAGCGCCACGCTTCC
CGAAGGGAGAAAGGCGGACAGGTATCCGGTAAGCGGCAGGGTCGGAACAGGA
GAGCGCACGAGGGAGCTTCCAGGGGGAAACGCCTGGTATCTTTATAGTCCTGT
CGGGTTTCGCCACCTCTGACTTGAGCGTCGATTTTTGTGATGCTCGTCAGGGGG
GCGGAGCCTATGGAAAAACGCCAGCAACGCGGCCTTTTTACGGTTCCTGGCCT
TTTGCTGGCCTTTTGCTCACATGTTCTTTCCTGCGTTATCCCCTGATTCTGTGGA
TAACCGTATTACCGCCTTTGAGTGAGCTGATACCGCTCGCCGCAGCCGAACGAC
CGAGCGCAGCGAGTCAGTGAGCGAGGAAGCGGAAGAGCGCCCAATACGCAAA
CCGCCTCTCCCCGCGCGTTGGCCGATTCATTAATGCAGCTGGCACGACAGGTT
TCCCGACTGGAAAGCGGGCAGTGAGCGCAACGCAATTAATGTGAGTTAGCTCA
CTCATTAGGCACCCCAGGCTTTACACTTTATGCTTCCGGCTCGTATGTTGTGTG
GAATTGTGAGCGGATAACAATTTCACACAGGAAACAGCTATGACCATGATTACG
CCAAGCGCGCAATTAACCCTCACTAAAGGGAACAAAAGCTGGAGCTCCACCGC
GGTGGCGGCCGCTCTAGAACTAGTGGATCCCCCGGGCTGCAGGAATTCGATAT

CAAGCTTATCGATACCGTCGACCTCGAGGGGGGGCCCGGTACCCAATTCGCCC
TATAGTGAGTCGTATTACGCGCGCTCACTGGCCGTCGTTTTACAACGTCGTGAC
TGGGAAAACCCTGGCGTTACCCAACTTAATCGCCTTGCAGCACATCCCCCTTTC
GCCAGCTGGCGTAATAGCGAAGAGGCCCGCACCGATCGCCCTTCCCAACAGTT
GCGCAGCCTGAATGGCGAATGGGACGCGCCCTGTAGCGGCGCATTAAGCGCG
GCGGGTGTGGTGGTTACGCGCAGCGTGACCGCTACACTTGCCAGCGCCCTAGC
GCCCGCTCCTTTCGCTTTCTTCCCTTCCTTTCTCGCCACGTTCGCCGGCTTTCC
CCGTCAAGCTCTAAATCGGGGGCTCCCTTTAGGGTTCCGATTTAGTGCTTTACG
GCACCTCGACCCCAAAAAACTTGATTAGGGTGATGGTTCACGTAGTGCAATTTA
GGTGGCACTTTTCGGGGAAATGTGCGCGGAACCCCTATTTGTTTATTTTTCTAAA
TACATTCAAATATGTATCCGCTCATGAGACAATAACCCTGATAAATGCTTCAATA
ATATTGAAAAAGGAAGAGTATGAGTATTCAACATTTCCGTGTCGCCCTTATTCCC
TTTTTTGCGGCATTTTGCCTTCCTGTTTTTGCTCACCCAGAAACGCTGGTGAAAG
TAAAAGATGCTGAAGATCAGTTGGGTGCACGAGTGGGTTACATCGAACTGGATC
TCAACAGCGGTAAGATCCTTGAGAGTTTTCGCCCCGAAGAACGTTTTCCAATGA
TGAGCACTTTTAAAGTTCTGCTATGTGGCGCGGTATTATCCCGTATTGACGCCG
GGCAAGAGCAACTCGGTCGCCGCATACACTATTCTCAGAATGACTTGGTTGAGT
ACTCACCAGTCACAGAAAAGCATCTTACGGATGGCATGACAGTAAGAGAATTAT
GCAGTGCTGCCATAACCATGAGTGATAACACTGCGGCCAACTTACTTCTGACAA
CGATCGGAGGACCGAAGGAGCTAACCGCTTTTTTGCACAACATGGGGGATCAT
GTAACTCGCCTTGATCGTTGGGAACCGGAGCTGAATGAAGCCATACCAAACGAC
GAGCGTGACACCACGATGCCTGTAGCAATGGCAACAACGTTGCGCAAACTATTA
ACTGGCGAACTACTTACTCTAGCTTCCCGGCAACAATTAATAGACTGGATGGAG
GCGGATAAAGTTGCAGGACCACTTCTGCGCTCGGCCCTTCCGGCTGGCTGGTT
TATTGCTGATAAATCTGGAGCCGGTGAGCGTGGGTCTCGCGGTATCATTGCAGC
ACTGGGGCCAGATGGTAAGCCCTCCCGTATCGTAGTTATCTACACGACGGGGA
GTCAGGCAACTATGGATGAACGAAATAGACAGATCGCTGAGATAGGTGCCTCAC
TGATTAAGCATTGGTAACTGTCAGACCAAGTTTACTCATATATACTTTAGATTGAT
TTAAAACTTCATTTTTAATTTAAAAGGATCTAGGTGAAGATCCTTTTTGATAATCT
CATGACCAAAATCCCTTAACGTGAGTTTTCGTTCCACTGAGCGTCAGACCCCGT
AGAAAAGATCAAAGGATCTTCTTGAGATCCTTTTTTTCTGCGCGTAATCTGCTGC
TTGCAAACAAAAAAACCACCGCTACCAGCGGTGGTTTGTTTGCCGGATCAAGAG
CTACCAACTCTTTTTCCGAAGGTAACTGGCTTCAGCAGAGCGCAGATACCAAAT
ACTGTCCTTCTAGTGTAGCCGTAGTTAGGCCACCACTTCAAGAACTCTGTAGCA
CCGCCTACATACCTCGCTCTGCTAATCCTGTTACCAGTGGCTGCTGCCAGTGGC
GATAAGTCGTGTCTTACCGGGTTGGACTCAAGACGATAGTTACCGGATAAGGCG
CAGCGGTCGGGCTGAACGGGGGGTTCGTGCACACAGCCCAGCTTGGAGCGAA
CGACCTACACCGAACTGAGATACCTACAGCGTGAGCTATGAGAAAGCGCCACG
CTTCCCGAAGGGAGAAAGGCGGACAGGTATCCGGTAAGCGGCAGGGTCGGAA
CAGGAGAGCGCACGAGGGAGCTTCCAGGGGGAAACGCCTGGTATCTTTATAGT
CCTGTCGGGTTTCGCCACCTCTGACTTGAGCGTCGATTTTTGTGATGCTCGTCA
GGGGGGCGGAGCCTATGGAAAAACGCCAGCAACGCGGCCTTTTTACGGTTCCT
GGCCTTTTGCTTATAAGGGATTTTGCCGATTTCGGCCTATTGGTTAAAAAATGAG
CTGATTTAACAAAAATTTAACGCGAATTTTAACAAAATATTAACGCTTACAATTTA

GGTGGCACTTTTCGGGGAAATGTGCGCGGAACCCCTATTTGTTTATTTTTCTAAA
TACATTCAAATATGTATCCGCTCATGAGACAATAACCCTGATAAATGCTTCAATA
ATATTGAAAAAGGAAGAGTATGAGTATTCAACATTTCCGTGTCGCCCTTATTCCC
TTTTTTGCGGCATTTTGCCTTCCTGTTTTTGCTCACCCAGAAACGCTGGTGAAAG
TAAAAGATGCTGAAGATCAGTTGGGTGCACGAGTGGGTTACATCGAACTGGATC
TCAACAGCGGTAAGATCCTTGAGAGTTTTCGCCCCGAAGAACGTTTTCCAATGA
TGAGCACTTTTAAAGTTCTGCTATGTGGCGCGGTATTATCCCGTATTGACGCCG
GGCAAGAGCAACTCGGTCGCCGCATACACTATTCTCAGAATGACTTGGTTGAGT
ACTCACCAGTCACAGAAAAGCATCTTACGGATGGCATGACAGTAAGAGAATTAT
GCAGTGCTGCCATAACCATGAGTGATAACACTGCGGCCAACTTACTTCTGACAA
CGATCGGAGGACCGAAGGAGCTAACCGCTTTTTTGCACAACATGGGGGATCAT
GTAACTCGCCTTGATCGTTGGGAACCGGAGCTGAATGAAGCCATACCAAACGAC
GAGCGTGACACCACGATGCCTGTAGCAATGGCAACAACGTTGCGCAAACTATTA
ACTGGCGAACTACTTACTCTAGCTTCCCGGCAACAATTAATAGACTGGATGGAG
GCGGATAAAGTTGCAGGACCACTTCTGCGCTCGGCCCTTCCGGCTGGCTGGTT
TATTGCTGATAAATCTGGAGCCGGTGAGCGTGGGTCTCGCGGTATCATTGCAGC
ACTGGGGCCAGATGGTAAGCCCTCCCGTATCGTAGTTATCTACACGACGGGGA
GTCAGGCAACTATGGATGAACGAAATAGACAGATCGCTGAGATAGGTGCCTCAC
TGATTAAGCATTGGTAACTGTCAGACCAAGTTTACTCATATATACTTTAGATTGAT
TTAAAACTTCATTTTTAATTTAAAAGGATCTAGGTGAAGATCCTTTTTGATAATCT
CATGACCAAAATCCCTTAACGTGAGTTTTCGTTCCACTGAGCGTCAGACCCCGT
AGAAAAGATCAAAGGATCTTCTTGAGATCCTTTTTTTCTGCGCGTAATCTGCTGC
TTGCAAACAAAAAAACCACCGCTACCAGCGGTGGTTTGTTTGCCGGATCAAGAG
CTACCAACTCTTTTTCCGAAGGTAACTGGCTTCAGCAGAGCGCAGATACCAAAT
ACTGTCCTTCTAGTGTAGCCGTAGTTAGGCCACCACTTCAAGAACTCTGTAGCA
CCGCCTACATACCTCGCTCTGCTAATCCTGTTACCAGTGGCTGCTGCCAGTGGC
GATAAGTCGTGTCTTACCGGGTTGGACTCAAGACGATAGTTACCGGATAAGGCG
CAGC

pRC2313

GGTCGGGCTGAACGGGGGGTTCGTGCACACAGCCCAGCTTGGAGCGAACGAC
CTACACCGAACTGAGATACCTACAGCGTGAGCTATGAGAAAGCGCCACGCTTCC
CGAAGGGAGAAAGGCGGACAGGTATCCGGTAAGCGGCAGGGTCGGAACAGGA
GAGCGCACGAGGGAGCTTCCAGGGGGAAACGCCTGGTATCTTTATAGTCCTGT
CGGGTTTCGCCACCTCTGACTTGAGCGTCGATTTTTGTGATGCTCGTCAGGGGG
GCGGAGCCTATGGAAAAACGCCAGCAACGCGGCCTTTTTACGGTTCCTGGCCT
TTTGCTGGCCTTTTGCTCACATGTGGCCTACGTTTTAATGCCAGCAAAAATGGTG
AATTACCTGGATAATCAACTCACGGGTGGGTTTAATAAACCGCGTCTCCAGATAT
TCATCAGGCTGATGAGCTTGATTGATGGAACCCGGACCGAGCACCAGCGTAGG
GCATAACGTTTGAATAAACGGCGCTTCGGTACAGTAATTCACCACTTCGGTTTTT
GCTCCGAGCAATTTCTCAACCACTTCAACCAGTTGATGATTCGGTGGGCATTCA
TAGCCAGGGATCGGCGGATGCAGCTCGTCGACCGTCAGACGACCCGGCCAGC
GTTCGCTCACCGGAGCCAATGCATCGTTGAGCAAACCATTAAGTTCATTGAGTG

TCATGCCAGGCAGCGGACGAATATCCATATGCAACTCACAGCAAGCGCAAATAC
GGTTAGAAGCGTCGCCACCGTGAATATGCCCGAGGTTGAGCGTAGGGTATGGC
ACGGTAAACGCTTCGTAGTGATAACGTTCTTTCAGGTTATCGCGCAATTGCAAAA
TATGCCCGATGGCGTCGTGCATTAGTTCGATAGCGTTAACTCCGCGTGCTGGAT
CGCTGGAGTGCCCCGACTGGCCCTGAATACGGATGGCGTTAGAGATATGACCT
TTATGTGCGCGTACCGGTTGTAGTGACGTCGGTTCGCCAATGATGGCGCAATCC
GGGCGCAGGGCGGTAGTTTCGGCAAAATAACGCGCTCCGGCCATACTGGTTTC
TTCATCAGCAGTCGCCAGAATGTAGAGCGGTTTTTTCAGTTTCGTGACGTCGAC
ATCGCGTAGCGCATCAAGGATAAACGCAAAAAAGCCTTTCATGTCGGCGGTGCC
TAAGCCGTAAAGCTTGCCGTCATGCTCCGTCAGTGTAAACGGATCGCGCGTCCA
GCGACCGTCATCAAATGGCACCGTATCGGTATGCCCCGCCAGCAACAAGCCGC
CAGCCCCCTGTCCGATACTTGCCAGCATATTGAATTTGTTGCGAGTTCCTGGAA
CAGGCTGCACTTCCACATTGAAGCCCAAATCTTTAAACCAGTCCGCCAGCAGAG
TAATTAAATCTGCATTGCTTTGATCGAGTGCCTCTTCCGTGGCGCTTATTGAAGG
TGTGGCAATCAGAGCGCGGTAAATCTCGATAAATGGCGGTAATTTGTTTTTCATT
GTTGACACACCTCTGGTCATGATAGTATCAATATTCATGCAGTATTTATGAATAA
AAATACACTAACGTTGAGCGTAATAAAACCCACCAGCCGTAAGGTGAATGTTTTA
CGTTTAACCTGGCAACCAGACATAAGAAGGTGAATAGCCCCGATGTTGAATACG
CTGATTGTGGGTGCCAGCGGCTACGCTGGCGCAGAGCTAGTGACCTATGTAAA
TCGCCATCCGCATATGAACATAACCGCTTTGACTGTTTCAGCGCAAAGCAATGA
TGCGGGAAAGTTAATCTCCGATTTGCATCCGCAGCTAAAAGGCATCGTTGATCT
GCCGTTGCAGCCGATGTCGGATATCAGCGAGTTTAGCCCAGGGGTGGACGTAG
TGTTTCTCGCCACCGCCCATGAAGTTAGCCACGATTTAGCGCCGCAGTTTCTTG
AAGCGGGCTGCGTGGTGTTCGACCTTTCCGGCGCGTTTCGTGTTAACGACGCC
ACCTTCTATGAAAAATATTACGGCTTTACCCATCAATACCCGGAACTGTTGGAAC
AGGCAGCCTACGGTCTGGCGGAGTGGTGCGGTAATAAATTAAAAGAAGCGAAT
TTGATTGCGGTGCCGGGCTGTTATCCGACGGCGGCACAGCTGGCGCTGAAACC
GTTGATTGATGCCGATCTTCTTGACCTCAATCAGTGGCCGGTGATCAACGCCAC
CAGCGGCGTGAGCGGTGCAGGGCGTAAAGCGGCCATTTCAAACAGCTTTTGTG
AAGTTAGCCTGCAACCGTATGGCGTCTTTACTCATCGCCATCAACCAGAGATCG
CCACACACCTCGGTGCTGACGTTATCTTCACCCCACATCTGGGCAATTTCCCGC
GCGGCATTCTCGAAACCATTACCTGCCGCCTGAAATCGGGTGTGACCCAGGCG
CAAGTCGCGCAAGTGTTACAGCAGGCGTATGCCCATAAACCGCTGGTGCGGCT
GTATGACAAAGGCGTTCCGGCGCTGAAAAATGTCGTTGGGCTGCCATTTTGCGA
TATCGGGTTTGCCGTTCAGGGCGAGCATCTGATTATTGTGGCGACCGAAGACAA
CTTACTGAAAGGCGCGGCGGCACAAGCGGTACAGTGCGCCAATATTCGTTTCG
GCTATGCGGAAACGCAGTCTCTTATTTAAGGGTGCAATGATGAATCCATTAATTA
TCAAACTGGGCGGCGTACTGCTGGATAGTGAAGAGGCGCTGGAACGTCTGTTT
AGCGCACTGGTGAATTATCGTGAGTCACATCAGCGTCCGCTGGTGATTGTGCAC
GGCGGCGGTTGCGTGGTGGATGAGCTGATGAAAGGGCTGAATCTGCCGGTGAA
AAAGAAAAATGGCCTGCGGGTGACGCCTGCGGATCAGATAGACATTATCACCG
GAGCACTGGCGGGAACGGCAAATAAAACCCTGTTGGCATGGGCGAAGAAACAT
CAGATTGCGGCCGTAGGTTTGTTTCTCGGTGACGGCGACAGCGTCAAAGTGAC
CCAGCTTGATGAAGAGTTAGGCCATGTTGGACTGGCGCAGCCAGGTTCGCCTA

AGCTTATCAACTCCTTGCTGGAGAACGGTTATCTGCCGGTGGTCAGCTCCATTG
GCGTAACAGACGAAGGGCAACTGATGAACGTCAATGCCGACCAGGCGGCAACG
GCGCTGGCGGCAACGCTGGGCGCGGATCTGATTTTGCTCTCCGACGTCAGCGG
CATTCTCGACGGCAAAGGGCAACGCATTGCCGAAATGACCGCCGCGAAAGCAG
AACAACTGATTGAGCAGGGCATTATTACTGACGGCATGATAGTGAAAGTGAACG
CGGCGCTGGATGCGGCCCGCACGCTGGGCCGTCCGGTAGATATCGCCTCCTG
GCGTCATGCGGAGCAGCTTCCGGCACTGTTTAACGGTATGCCGATGGGTACGC
GGATTTTAGCTTAAGTTTTGTTGGCCGGAGGCGCAGCTTTCCGGCATTGAATTT
CAAAATAAGGAAACAGAGTTATGGCACTTTGGGGCGGGCGTTTTACCCAGGCA
GCAGATCAACGGTTCAAACAATTCAACGACTCACTGCGCTTTGATTACCGTCTG
GCGGAGCAGGATATTGTTGGCTCTGTGGCCTGGTCCAAAGCCCTGGTCACGGT
AGGCGTGTTAACCGCAGAAGAGCAGGCGCAACTGGAAGAGGCGCTGAACGTGT
TGCTGGAAGATGTTCGCGCCAGGCCACAACAAATCCTTGAAAGCGACGCCGAA
GATATCCATAGCTGGGTGGAAGGCAAACTGATCGACAAAGTGGGCCAGTTAGG
CAAAAAGCTGCATACCGGGCGTAGCCGTAATGATCAGGTAGCGACTGACCTGA
AACTGTGGTGCAAAGATACCGTTAGCGAGTTACTGACGGCTAACCGGCAGCTG
CAATCGGCGCTGGTGGAAACCGCACAAAACAATCAGGACGCGGTAATGCCAGG
TTACACTCACCTGCAACGCGCCCAGCCGGTGACGTTCGCGCACTGGTGCCTGG
CCTATGTTGAGATGCTGGCGCGTGATGAAAGCCGTTTGCAGGATGCGCTTAAGC
GTCTGGATGTCAGCCCGCTAGGCTGTGGCGCGCTGGCGGGAACGGCCTATGAA
ATCGACCGTGAACAGTTAGCAGGCTGGCTGGGCTTTGCTTCGGCGACCCGTAA
CAGTCTCGACAGCGTTTCTGACCGTGACCATGTGTTGGAACTGCTTTCTGCTGC
CGCTATCGGCATGGTGCATCTGTCGCGTTTTGCTGAAGATCTGATTTTCTTTAAC
ACCGGCGAAGCGGGGTTTGTGGAGCTTTCTGACCGCGTGACTTCCGGTTCATC
ATTAATGCCGCAGAAGAAAAACCCGGATGCGCTGGAGCTGATTCGCGGTAAAT
GCGGCCGGGTGCAGGGGGCGTTAACCGGCATGATGATGACGCTGAAAGGTTT
GCCGCTGGCTTACAACAAAGATATGCAGGAAGACAAAGAAGGTCTGTTCGACG
CGCTCGATACCTGGCTGGACTGCCTGCATATGGCGGCGCTGGTGCTGGACGGC
ATTCAGGTGAAACGTCCACGTTGCCAGGAAGCGGCTCAGCAGGGTTACGCCAA
CGCCACCGAACTGGCGGATTATCTGGTGGCGAAAGGCGTACCGTTCCGCGAGG
CGCACCATATTGTTGGTGAAGCGGTGGTGGAAGCCATTCGTCAGGGCAAACCG
CTGGAAGATCTGCCGCTCAGTGAGTTGCAGAAATTCAGTCAGGTGATTGACGAA
GATGTCTATCCGATTCTGTCGCTGCAATCGTGCCTCGACAAGACATGTTCTTTCC
TGCGTTATCCCCTGATTCTGTGGATAACCGTATTACCGCCTTTGAGTGAGCTGAT
ACCGCTCGCCGCAGCCGAACGACCGAGCGCAGCGAGTCAGTGAGCGAGGAAG
CGGAAGAGCGCCCAATACGCAAACCGCCTCTCCCCGCGCGTTGGCCGATTCAT
TAATGCAGCTGGCACGACAGGTTTCCCGACTGGAAAGCGGGCAGTGAGCGCAA
CGCAATTAATGTGAGTTAGCTCACTCATTAGGCACCCCAGGCTTTACACTTTATG
CTTCCGGCTCGTATGTTGTGTGGAATTGTGAGCGGATAACAATTTCACACAGGA
AACAGCTATGACCATGATTACGCCAAGCGCGCAATTAACCCTCACTAAAGGGAA
CAAAAGCTGGAGCTCCACCGCGGTGGCGGCCGCTCTAGAACTAGTGGATCCCC
CGGGCTGCAGGAATTCGATATCAAGCTTATCGATACCGTCGACCTCGAGGGGG
GGCCCGGTACCCAATTCGCCCTATAGTGAGTCGTATTACGCGCGCTCACTGGC
CGTCGTTTTACAACGTCGTGACTGGGAAAACCCTGGCGTTACCCAACTTAATCG

CCTTGCAGCACATCCCCCTTTCGCCAGCTGGCGTAATAGCGAAGAGGCCCGCA
CCGATCGCCCTTCCCAACAGTTGCGCAGCCTGAATGGCGAATGGGACGCGCCC
TGTAGCGGCGCATTAAGCGCGGCGGGTGTGGTGGTTACGCGCAGCGTGACCG
CTACACTTGCCAGCGCCCTAGCGCCCGCTCCTTTCGCTTTCTTCCCTTCCTTTCT
CGCCACGTTCGCCGGCTTTCCCCGTCAAGCTCTAAATCGGGGGCTCCCTTTAG
GGTTCCGATTTAGTGCTTTACGGCACCTCGACCCCAAAAAACTTGATTAGGGTG
ATGGTTCACGTAGTGCAATTTAGGTGGCACTTTTCGGGGAAATGTGCGCGGAAC
CCCTATTTGTTTATTTTTCTAAATACATTCAAATATGTATCCGCTCATGAGACAAT
AACCCTGATAAATGCTTCAATAATATTGAAAAAGGAAGAGTATGAGTATTCAACA
TTTCCGTGTCGCCCTTATTCCCTTTTTTGCGGCATTTTGCCTTCCTGTTTTTGCTC
ACCCAGAAACGCTGGTGAAAGTAAAAGATGCTGAAGATCAGTTGGGTGCACGA
GTGGGTTACATCGAACTGGATCTCAACAGCGGTAAGATCCTTGAGAGTTTTCGC
CCCGAAGAACGTTTTCCAATGATGAGCACTTTTAAAGTTCTGCTATGTGGCGCG
GTATTATCCCGTATTGACGCCGGGCAAGAGCAACTCGGTCGCCGCATACACTAT
TCTCAGAATGACTTGGTTGAGTACTCACCAGTCACAGAAAAGCATCTTACGGAT
GGCATGACAGTAAGAGAATTATGCAGTGCTGCCATAACCATGAGTGATAACACT
GCGGCCAACTTACTTCTGACAACGATCGGAGGACCGAAGGAGCTAACCGCTTTT
TTGCACAACATGGGGGATCATGTAACTCGCCTTGATCGTTGGGAACCGGAGCTG
AATGAAGCCATACCAAACGACGAGCGTGACACCACGATGCCTGTAGCAATGGC
AACAACGTTGCGCAAACTATTAACTGGCGAACTACTTACTCTAGCTTCCCGGCA
ACAATTAATAGACTGGATGGAGGCGGATAAAGTTGCAGGACCACTTCTGCGCTC
GGCCCTTCCGGCTGGCTGGTTTATTGCTGATAAATCTGGAGCCGGTGAGCGTG
GGTCTCGCGGTATCATTGCAGCACTGGGGCCAGATGGTAAGCCCTCCCGTATC
GTAGTTATCTACACGACGGGGAGTCAGGCAACTATGGATGAACGAAATAGACAG
ATCGCTGAGATAGGTGCCTCACTGATTAAGCATTGGTAACTGTCAGACCAAGTT
TACTCATATATACTTTAGATTGATTTAAAACTTCATTTTTAATTTAAAAGGATCTAG
GTGAAGATCCTTTTTGATAATCTCATGACCAAAATCCCTTAACGTGAGTTTTCGT
TCCACTGAGCGTCAGACCCCGTAGAAAAGATCAAAGGATCTTCTTGAGATCCTT
TTTTTCTGCGCGTAATCTGCTGCTTGCAAACAAAAAAACCACCGCTACCAGCGG
TGGTTTGTTTGCCGGATCAAGAGCTACCAACTCTTTTTCCGAAGGTAACTGGCTT
CAGCAGAGCGCAGATACCAAATACTGTCCTTCTAGTGTAGCCGTAGTTAGGCCA
CCACTTCAAGAACTCTGTAGCACCGCCTACATACCTCGCTCTGCTAATCCTGTTA
CCAGTGGCTGCTGCCAGTGGCGATAAGTCGTGTCTTACCGGGTTGGACTCAAG
ACGATAGTTACCGGATAAGGCGCAGCGGTCGGGCTGAACGGGGGGTTCGTGC
ACACAGCCCAGCTTGGAGCGAACGACCTACACCGAACTGAGATACCTACAGCG
TGAGCTATGAGAAAGCGCCACGCTTCCCGAAGGGAGAAAGGCGGACAGGTATC
CGGTAAGCGGCAGGGTCGGAACAGGAGAGCGCACGAGGGAGCTTCCAGGGGG
AAACGCCTGGTATCTTTATAGTCCTGTCGGGTTTCGCCACCTCTGACTTGAGCG
TCGATTTTTGTGATGCTCGTCAGGGGGGCGGAGCCTATGGAAAAACGCCAGCA
ACGCGGCCTTTTTACGGTTCCTGGCCTTTTGCTTATAAGGGATTTTGCCGATTTC
GGCCTATTGGTTAAAAAATGAGCTGATTTAACAAAAATTTAACGCGAATTTTAAC
AAAATATTAACGCTTACAATTTAGGTGGCACTTTTCGGGGAAATGTGCGCGGAA
CCCCTATTTGTTTATTTTTCTAAATACATTCAAATATGTATCCGCTCATGAGACAA
TAACCCTGATAAATGCTTCAATAATATTGAAAAAGGAAGAGTATGAGTATTCAAC

ATTTCCGTGTCGCCCTTATTCCCTTTTTTGCGGCATTTTGCCTTCCTGTTTTTGCT
CACCCAGAAACGCTGGTGAAAGTAAAAGATGCTGAAGATCAGTTGGGTGCACG
AGTGGGTTACATCGAACTGGATCTCAACAGCGGTAAGATCCTTGAGAGTTTTCG
CCCCGAAGAACGTTTTCCAATGATGAGCACTTTTAAAGTTCTGCTATGTGGCGC
GGTATTATCCCGTATTGACGCCGGGCAAGAGCAACTCGGTCGCCGCATACACTA
TTCTCAGAATGACTTGGTTGAGTACTCACCAGTCACAGAAAAGCATCTTACGGAT
GGCATGACAGTAAGAGAATTATGCAGTGCTGCCATAACCATGAGTGATAACACT
GCGGCCAACTTACTTCTGACAACGATCGGAGGACCGAAGGAGCTAACCGCTTTT
TTGCACAACATGGGGGATCATGTAACTCGCCTTGATCGTTGGGAACCGGAGCTG
AATGAAGCCATACCAAACGACGAGCGTGACACCACGATGCCTGTAGCAATGGC
AACAACGTTGCGCAAACTATTAACTGGCGAACTACTTACTCTAGCTTCCCGGCA
ACAATTAATAGACTGGATGGAGGCGGATAAAGTTGCAGGACCACTTCTGCGCTC
GGCCCTTCCGGCTGGCTGGTTTATTGCTGATAAATCTGGAGCCGGTGAGCGTG
GGTCTCGCGGTATCATTGCAGCACTGGGGCCAGATGGTAAGCCCTCCCGTATC
GTAGTTATCTACACGACGGGGAGTCAGGCAACTATGGATGAACGAAATAGACAG
ATCGCTGAGATAGGTGCCTCACTGATTAAGCATTGGTAACTGTCAGACCAAGTT
TACTCATATATACTTTAGATTGATTTAAAACTTCATTTTTAATTTAAAAGGATCTAG
GTGAAGATCCTTTTTGATAATCTCATGACCAAAATCCCTTAACGTGAGTTTTCGT
TCCACTGAGCGTCAGACCCCGTAGAAAAGATCAAAGGATCTTCTTGAGATCCTT
TTTTTCTGCGCGTAATCTGCTGCTTGCAAACAAAAAAACCACCGCTACCAGCGG
TGGTTTGTTTGCCGGATCAAGAGCTACCAACTCTTTTTCCGAAGGTAACTGGCTT
CAGCAGAGCGCAGATACCAAATACTGTCCTTCTAGTGTAGCCGTAGTTAGGCCA
CCACTTCAAGAACTCTGTAGCACCGCCTACATACCTCGCTCTGCTAATCCTGTTA
CCAGTGGCTGCTGCCAGTGGCGATAAGTCGTGTCTTACCGGGTTGGACTCAAG
ACGATAGTTACCGGATAAGGCGCAGC

Spacer 1a	AAAC AGGCACCCCAGGCTTTACACTTTATGCTTCG
Spacer 1b	AAAACGAAGCATAAAGTGTAAAGCCTGGGGTGCCT
Spacer 2a	AAAC TACGAGCCGGAAGCATAAAGTGTAAAGCCTG
Spacer 2b	AAAACAGGCTTTACACTTTATGCTTCCGGCTCGTA
Spacer 3a	AAAC TCCGGCTCGTATGTTGTGTGAAATTGTGAGG
Spacer 3b	AAAACCTCACAATTTCACACAACATACGAGCCGGA
Spacer 4a	AAAC TCCGCTCACAATTTCACACAACATACGAGCG
Spacer 4b	AAAACGCTCGTATGTTGTGTGAAATTGTGAGCGGA
Spacer 5a	AAAC TGAAATTGTGAGCGGATAACAATTTCACACG
Spacer 5b	AAAACGTGTGAAATTGTTATCCGCTCACAATTTCA
Spacer 6a	AAAC AAACAGCTATGACCATGATTACGGATTCACG
Spacer 6b	AAAACGTGAATCCGTAATCATGGTCATAGCTGTTT
Spacer 7a	AAAC GGTTTTCCCAGTCACGACGTTGTAAAACGAG
Spacer 7b	AAAACTCGTTTTACAACGTCGTGACTGGGAAAACC
Spacer 8a	AAAC TGAATGGCGAATGGCGCTTTGCCTGGTTTCG
Spacer 8b	AAAACGAAACCAGGCAAAGCGCCATTCGCCATTCA
Spacer 9a	AAAC ACCCGTCGGATTCTCCGTGGGAACAAACGGG
Spacer 9b	AAAACCCGTTTGTTCCCACGGAGAATCCGACGGGT
Spacer 10a	AAAC TCACATTTAATGTTGATGAAAGCTGGCTACG
Spacer 10b	AAAACGTAGCCAGCTTTCATCAACATTAAATGTGA

Supplemental Table 2 CRISPR spacer sequences

Sequences of the oligonucleotides that were annealed together to make the oligoduplexes encoding the spacer sequences encoding the ten candidate gRNAs used in Figure 1.

RNC target top	CGGATTCACTGGCCGTCGTTTTACAACGTCGTGACTGGGAAAACCCTGGC	Substrate used in EMSAs to demonstrate reconstituted sgRNA-dCas9-transposase binding to target DNA. Anneals with RNC target bottom. sgRNA hybridizes with underlined sequence.
RNC target bottom	[Cy5]-GCCAGGGTTTTCCCAGTCACGACGTTGTAAAACGACGGCCAGTGAATCCG	Substrate used in EMSAs to demonstrate reconstituted sgRNA-dCas9-transposase binding to target DNA. Anneals with RNA target top
Hsmar1 substrate top	ACTAGTGGATCCCCCGGGCTGCAGGAATTCTATTAGGTTGGTGCAAAAGTAATTGCGGTTTTGGATCCCTGT-[Cy5]	Substrate used in EMSAs to demonstrate transposase binding to inverted terminal repeat (ITR). Anneals with Hsmar1 substrate bottom. ITR is underlined.
Hsmar1 substrate bottom	ACAGGGATCCAAAACCGCAATTACTTTTGCACCAACCTAATAGAATTCCTGCAGCCCGGGGGATCCACTAGT-[Cy5]	Substrate used in EMSAs to demonstrate transposase binding to ITR. Anneals with Hsmar1 substrate top. ITR is underlined.
sgRNA	GUCACGACGUUGUAAAACGA*guuuuagagcua****GAAA****UAGCAAGUUAAAAUAAGGCUAGUCCGUUAUCAACUUGAAAAAGUGGCACCGAGUCGGUGCUUUU	sgRNA used for reconstitution with purified dCas9-transposase. Green sequence is the spacer (crRNA targeting sequence), Italicized sequence is the scaffold composed of: i) lowercase = crRNA repeat, ii) bold = tetraloop and iii) blue = tracrRNA sequence.

Supplemental Table 3 Oligonucleotide sequences